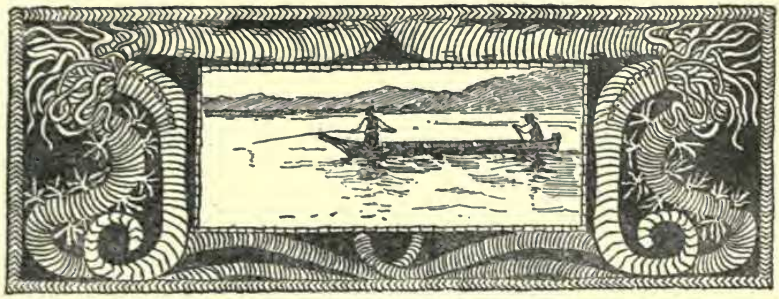


TUBICOLOUS ANNELIDS OF THE TRIBES SABELLIDES AND SERPULIDES FROM THE PACIFIC OCEAN

BY KATHARINE JEANNETTE BUSH, PH.D.

CONTENTS

Introduction 169
Species previously recorded from the Pacific 172
New genera 178
Species new to the region 179
Systematic discussion 183
Bibliography 269
Index 292

INTRODUCTION

PRACTICALLY nothing was known of the annelids of the North Pacific coast before Johnson's valuable reports of 1897 and 1901 — the first entitled 'A Preliminary Account of the Marine Annelids of the Pacific Coast,' the other 'The Polychæta of the Puget Sound Region.' This is especially true of Alaska, a few species only having been recorded north of Vancouver Island, British Columbia; therefore the collections made by Dr. William E. Ritter, of the University of California, and Dr. Wesley R. Coe, of Yale University, as members of the Harriman Alaska Expedition of 1899, are of great interest.

Of the 35 species from Alaska described as new to the North Pacific fauna (p. 179), only 4 — *Spirorbis spirillum* (Linné) and variety *lucidus* Montagu, *Spirorbis mörchi* Levinsen, *Spirorbis quadrangularis* Stimpson, and *Spirorbis violaceus* Levinsen — appear to be circumpolar; of these but one — *Spirorbis spirillum* (Linné), with its variety *lucidus* Montagu — extends southward along the California coast. *Schizobranchia insignis* sp. nov. appears at Vancouver Island, where also *Eudistylia tenella* sp. nov. is found.

Of the remaining species, 9, as far as known, occur only on the coast of California (at Pacific Grove), 1 on the coast of Mexico, and 1 on the coast of Honolulu.

The 148 species given in the list (p. 172) as previously recorded from the Pacific were about equally distributed north and south of the equator, there being but 9 more above than below it before Moore (1904) added 13 from the coast of Japan; but in the North Pacific those forming the more or less flexible tubes are numerous, while in the South Pacific those building firm calcareous ones predominate. Only 8, however, have thus far been found from Puget Sound northward along the coast of Alaska.

As will be seen by the following list, most of the forms, the larger number of which are of unusual size, are representatives of well-known genera.

Among the Polynoidæ and closely related families, as well as among the Sabellidæ and Serpulidæ, are to be found most of the unique forms, although there are two very interesting sexual individuals, one similar to that figured by Örsted (1843) as *Polybostrichus*, now placed with the Syllidæ, and another, of unknown relationship, which has the ventral surface covered by large clusters of eggs attached to each segment in pairs.

LIST OF FAMILIES AND KNOWN GENERA REPRESENTED IN THE COLLECTION.

APHRODITACÆ
Iphione ?
POLYNOIDÆ
Lepidonotus, 3 sp.
Harmothoe, 8 sp.
Lænilla ?
Polynoe, 2 sp.
Lepidametria ?

SIGALIONIDÆ
Phlöe
PHYLLODOCIDÆ
Phyllodoce, 4 sp.
Eulalia, 2 sp.
Eteone, 4 sp.
NEPHTHYDÆ
Nephthys, 9 sp.
GLYCERIDÆ
Glycera, 4 sp.
STAUROCEPHALIDÆ
Staurocephalus
LUMBRINEREIDÆ
Lumbrinereis, etc., 4 sp.
EUNICIDÆ
Leodice
LYCORIDÆ
Nereis, 7 sp.
SYLLIDÆ
Autolytus (Polybostrichus)
Syllis
Gnathosyllis, etc.
SPIONIDÆ
Scolecolepis
Polydora
Spio, etc.
CHÆTOPTERIDÆ
Chætopterus
CIRRATULIDÆ
Cirratulus
ARICIIDÆ
Aricia
OPHELIIDÆ
Ammotrypane
Ophelia
CHLORÆMIDÆ
Trophonia, 3 sp.
Flabelligera, 5 sp.
Brada, 4 sp.
EUPHROSYNIDÆ
Spinther?
AMPHINOMIDÆ
Notopygus?
SCALIBREGMIDÆ
Eumenia
Scalibregma
TELETHUSÆ
Arenicola, 2 sp.
CAPITELLIDÆ
Notomastus
MALDANIDÆ
Nicomache
Axiothella
AMMOCHARIDÆ
Ammochares, 2 sp.
AMPHICTENIDÆ
Pectinaria, 3 sp.
HERMELLIDÆ
Sabellaria
TEREBELLIDÆ
Amphitrite, 2 sp.
Terebella
Nicolea
Polycirrus
SABELLIDÆ
Sabella, 4 sp.
Parasabella, 2 sp.
Aspeira
Schizobranchia, 5 sp.
Eudistylia, 4 sp.
Chone
ERIOGRAPHIDIDÆ
Myxicola, 2 sp.
SERPULIDÆ
Serpula
Crucigera, 3 sp.
Hyalopomatopsis
Spirorbis, 10 sp.

As an aid to students interested in the many much misunderstood forms found among the Sabellides and Serpulides, and also because so little is known of those from the Pacific, descriptions and figures of a few species collected in 1901 at Pacific

Grove, California, by Dr. Coe, are added, and also some facts regarding the few known species obtained farther south.

The *Spirorbis* group, recently found of so much interest (p. 252), has been thoroughly studied as a whole; the results are here given in as condensed a form as seems possible without interfering with a clear understanding of the many species.

The three following lists, although not properly a part of the introduction, are placed here for convenience.

SPECIES PREVIOUSLY RECORDED FROM THE PACIFIC ARRANGED WITH REFERENCE TO THEIR GEOGRAPHICAL DISTRIBUTION.

North Pacific.

Bering Sea:

1. *Pseudopotamilla reniformis* (Leuckart, 1849, as *Sabella*,[1] figures, + Malmgren 1867, as *Potamilla*, figures, + Marenzeller 1890). Also North Atlantic.
2. *Euchone analis* (Kröyer) Malmgren 1865, figures, + Marenzeller 1890. Also North Atlantic.

Puget Sound Region:

3. *?*[2] —— *vancouveri* (Kinberg 1866, as *Sabella*). See p. 197.
4. *Eudistylia polymorpha* (Johnson 1901, as *Bispira*, figures). South to Pacific Grove, California.
5. *Megachone aurantiaca* Johnson 1901, figures.
6. *Myxicola pacifica* Johnson 1901, figures.
7. *Serpula columbiana* Johnson 1901, figures. South to San Francisco, California.
8. *Crucigera zygophora* (Johnson 1901, as *Serpula*, figures).

Central America to United States of Colombia:

9. *Hydroides crucigera* (Mörch 1863, as *Eucarphus*, figures). Central America, 14 fms.
10. *Pomatostegus kröyeri* Mörch 1863, figures. Central America.

[1] When the generic name has been changed by subsequent writers, the original one is also given after the name of the author.

[2] An interrogation mark in the place of the generic name indicates that the description of the species is not sufficiently clear to determine its position.

11. *Spirobranchus incrassatus* (Kröyer) Mörch 1863, figures, + Ehlers 1887, figures.
12. *Spirorbis marioni* Caullery and Mesnil 1897, figures. Panama.
13. *Spirorbis langerhansi* Caullery and Mesnil 1897, figures. Panama.

Honolulu:

14. *Dasychone havaica* (Kinberg 1866, as *Sabella*).
15. *Demonax kruscnsterni* Kinberg 1866.
16. *Demonax cooki* Kinberg 1866.

Japan:

17. *Sabella fullo* Grube 1877.
18. *Sabella tricolor* Grube 1877.
19. *Sabella aulaconota* Marenzeller 1884, figures.
20. *Sabella japonica* Moore 1904, figures. 63–75 fms.
21. *Potamilla acuminata* Moore 1904, figures. 153 fms.
22. *Aspeira* sp. ? (Marenzeller 1884, as *Potamilla torelli* Malmgren, figures).
23. *Pseudopotamilla suavis* (Grube 1877, as *Potamilla*).
24. *Pseudopotamilla myriops* (Marenzeller 1884, as *Potamilla*, figures).
25. *Paralaonome japonica* (Marenzeller 1884, as *Laonome*, figures).
26. *Laonome tridentata* Moore 1904, figures. 63–75 fms.
27. *Dasychone japonica* McIntosh 1885, figures, + Moore 1904. 50 fms.
28. *Demonax picta* (McIntosh 1885, as *Dasychone*, figures). 50 fms.
29. *Hypsicomus phæotænia* (Schmarda 1861, as *Sabella*, figures) Marenzeller 1884, figures. Also Ceylon.
30. *Hypsicomus lyra* Moore 1904, figures. 63–75 fms.
31. *Euchone alicaudata* Moore 1904, figures. 153 fms.
32. *Myxicola platychæta* Marenzeller 1884, figures.
33. *Protula geniculata* Moore 1904, figures. 63–75 fms.
34. *Apomatus enosimæ* Marenzeller 1884, figures.
35. *?—— ctenophora* (Moore 1904, as *Vermilia*, figures).
36. *?—— pluriannulata* (Moore 1904, as *Vermilia*, figures). 45 fms.
37. *Hydroides multispinosa* Marenzeller 1884, figures, + McIntosh 1885, figures, *non* Fischli 1900, figures. 8–50 fms.
38. *Eupomatus fusicola* Mörch 1863.
39. *Eupomatus exaltatus* Marenzeller 1884, figures.

40. *?* —— *diplochone* (Grube 1877, as *Hydroides*).[1]
41. *Serpula jukesii* Baird 1865 (?), figures, + Grube[2] 1877.
42. *Serpula granulosa* Marenzeller 1884, figures.
43. *Omphalopomopsis langerhansii* (Marenzeller 1884, as *Omphalopoma*, figures) Saint-Joseph 1894, as type.
44. *Pomatostegus latiscapus* Marenzeller 1884, figures, + Moore 1904.
45. *Pomatoceros helicoides* Marenzeller 1884, figures.
46. *Pomatoceros auritubis* Moore 1904, figures. 45 fms.
47. *Spirorbis argutus* Bush 1904, figures. 34 fms.
48. *Spirorbis bellulus* Bush 1904, figures. 63–75 fms.
49. *Spirorbis dorsatus* Bush 1904. 63–75 fms.
50. *Spirorbis foraminosus* Bush[3] 1904, figures. 34 fms.

Hong Kong:

51. *Dasychone orientalis* McIntosh 1885, figures. 10 fms.

Philippine Islands:

52. *Sabella acrophthalmos* Grube 1878.
53. *Dasychone cingulata* Grube 1878, figures.
54. *Dasychone boholensis* Grube 1878.
55. *Dasychone serratibranchis* Grube 1878, figures.
56. *Eurato pyrrhogaster* (Grube 1878, as *Sabella*, figures) Saint-Joseph 1894, first species as type.
57. *Eurato porifera* (Grube 1878, as *Sabella*, figures) Saint-Joseph 1894.
58. *Eurato manicata* (Grube 1878, as *Sabella*, figures) Saint-Joseph 1894.
59. *Eurato notata* (Grube 1878, as *Sabella*) Saint-Joseph 1894.
60. *?* —— *spectabilis* (Grube 1878, as *Sabella*, figures, + Marenzeller 1884, as *Laonome*, figures, + Saint-Joseph 1894, as *Sabellastarte*).
61. *?* —— *zebuensis* (McIntosh 1885, as *Sabella*, figures). 95 fms.
62. *?* —— *tenuitorquus* (Grube 1878, as *Potamilla*, figures).

[1] The operculum is described as two complete funnels bordered with deep serrations, one above the other and may prove to be a *Eupomatus*.

[2] Grube's description of this species does not appear to agree very closely with that of Baird.

[3] The description and figures of these four species (47–50) of *Spirorbis* were prepared for insertion in Mr. J. Percy Moore's report on the *Sabellas* and *Serpulas* collected off the coast of Japan by the U. S. steamer *Albatross* in 1900. This is now passing through the press, with every probability of early publication. Mr. Moore has very kindly furnished a list of species included in this paper.

63. *Pseudopotamilla polyophthalmos* (Grube 1878, as *Potamilla*, figures).
64. *Pseudopotamilla oligophthalmos* (Grube 1878, as *Potamilla*, figures).
65. *Myxicola ommatophora* Grube 1878, figures.
66. *Eucarphus cumingii* Mörch 1863.
67. *Schizocraspedon furcifera* (Grube 1878, as *Hydroides*, figures). See p. 225.
68. *Glossopsis minax* (Grube 1878, as *Hydroides*, figures). See p. 225.
69. *?* —— *philippensis* (McIntosh 1885, as *Serpula*, figures). 1050 fms.
70. *Dasynema chrysogyrus* (Grube 1878, as *Serpula*, figures) Saint-Joseph 1894, as type.
71. *Pomatostegus actinocerus* Mörch 1863, figures, + Grube 1878, as *Serpula*.
72. *Spirobranchus semperi* Mörch 1863.
73. *Spirobranchus tricornigerus* (Grube 1878, as *Serpula*, figures).
74. *Spirobranchus quadricornis* (Grube 1878, as *Serpula*, figures).
75. *Pomatoceros bucephalus* Mörch 1863.
76. *Placostegus porosus* (Daudin 1800, as *Vermetus*, figure) Mörch 1863.
77. *Placostegus ornatus* (Sowerby, as *Serpula*, figure) Mörch 1863.
78. *Omphalopoma umbilicata* (Mörch 1863, as *Placostegus*).
79. *Galeolaria hystrix* Mörch 1863.
80. *Galeolaria tetracera* (Schmarda 1861, as *Pomatoceros*, figure).
81. *Ditrypa gracillima* Grube 1878.

Ternate Island:

82. *Dasychonopsis maculata* (Fischli 1900, as *Dasychone*, figures).
83. *Protulopsis nigra-nucha* Fischli 1900, figures.
84. *Eucarphus ternatensis* (Fischli 1900, as *Hydroides multispinosa* Marenzeller, variety, figures).

South Pacific.

Peru and Chili:

85. *?* —— *tilosaulus* (Schmarda 1861, as *Sabella*, figures, + Kinberg 1866, as *Demonax*, + Ehlers 1901, as *Sabella*).
86. *?* —— *leucaspis* (Kinberg 1866, as *Demonax*, + Ehlers 1901).

87. *?* —— *incertus* (Kinberg 1866, as *Demonax*, + Ehlers 1901).
88. *Zopyrus?* sp. (McIntosh 1885, as *Vermilia*, figures). 1450 fms.
89. *Placostegus* sp. ? Ehlers 1900, + 1901.
90. *Spirorbis chilensis* Gray 1849, + Ehlers 1901.

Straits of Magellan and vicinity:

91. *Sabella* sp. Ehlers 1901. 8–50 fms.
92. *Sabella magelhænsis* Kinberg 1866, + Ehlers 1901.
93. *Paralaonome ? antarctica* (Kinberg 1866, as *Laonome*, + Ehlers 1897, 1900, 1901). 2–12 fms.
94. *Dasychonopsis curta* (Ehlers 1901, as *Dasychone*, figures). 20 fms.
95. *Fabricia alata* Ehlers 1897, figures, + 1901. 1–2 fms.
96. *Oria limbata* Ehlers 1897, figures, + 1901. 5 fms.
97. *Serpula narconensis* Baird[1] 1864, figures, variety *magellanica* McIntosh 1885, figures. 15–175 fms.
98. *Zopyrus loveni* Kinberg 1866, + Ehlers 1901.
99. *Metavermilia nigropileata* (Ehlers 1900, + 1901, as *Vermilia*, figures).
100. *Spirorbis nordenskjöldi* Ehlers 1900, + 1901.
101. *Spirorbis perrieri* Caullery and Mesnil 1897, + Ehlers 1900, + 1901. 20 fms.
102. *Spirorbis lebruni* Caullery and Mesnil 1897, + Ehlers 1900, + 1901. 20–25 fms.
103. *Spirorbis levinseni* Caullery and Mesnil 1897, + Ehlers 1901.
104. *Spirorbis patagonicus* Caullery and Mesnil 1897, + Ehlers 1901.
105. *Spirorbis claparedei* Caullery and Mesnil 1897, + Ehlers 1901.
106. *Spirorbis aggregatus* Caullery and Mesnil 1897, + Ehlers 1901.

Figi Islands and vicinity:

107. *Sabella samoensis* Grube 1870.
108. *Dasychone cingulata* Grube 1870.

Mid Ocean:

109. *?* —— *ornatus*[2] (McIntosh 1885, as *Placostegus*, figures). 2375 to 3125 fms.

[1] Ehlers 1901 refers this species to *Serpula vermicularis* Linné 1767.

[2] This species is not a *Placostegus* as the uncini have but few coarse teeth similar to *Serpula*. The operculum is protected by a calcareous plate. It is not probable that this is identical with *P. ornatus* Sowerby from the Philippine Islands.

110. *?* —— *benthalianus* (McIntosh 1885, as *Placostegus*, figures). 3125 fms.
111. *Protoplacostegus mörchii* (McIntosh 1885, as *Placostegus*, figures). 2375 fms. See p. 226

New Zealand:

112. *?* —— *ceratodaula* (Schmarda 1861, as *Sabella*, figures).
113. *?* —— *armata* (Quatrefages 1865, as *Sabella*, figures).
114. *?* —— *grandis* (Baird 1865, as *Sabella*).
115. *Apomatus elisabethæ* McIntosh 1885, figures.
116. *Galeolaria hystrix* Mörch 1863, figures.
117. *Galeolaria boltoni* (Baird 1865, as *Eupomatus*, figures).
118. *Eucarphus cumingii* Mörch 1863, variety *navalis* Mörch 1863.
119. *Sclerostyla zelandica* (Baird 1865, as *Serpula*, figures).
120. *Placostegus cariniferus* (Gray 1843) Baird 1865.
121. *Placostegus cæruleus* Schmarda 1861, figures, + Mörch 1863.
122. *Spirorbis zelandicus* Gray 1843, + Mörch 1863.

Australia:

123. *Spirographis australiensis* Haswell 1884.
124. *?* —— *velata* (Haswell 1884, as *Sabella*, figures).
125. *?* —— *punctulata* (Haswell 1884, as *Sabella*, figures).
126. *?* —— *sulcata* (Ehlers 1897, as *Sabella*) (*Sabella fusca* McIntosh 1885, figures, *non* Grube). 2–10 fms.
127. *Filograna divaricata* Mörch 1863 (*Serpula filigrana* Lamarck 1818).
128. *Salmacina australis* Haswell 1884, figures.
129. *Galeolaria cæspitosa* Lamarck 1818, + Mörch 1863, figures, + Haswell 1884, as *Vermilia*.
130. *Galeolaria elongata* Lamarck 1818, + Mörch 1863.
131. *Galeolaria decumbens* Sowerby, figures, + Mörch 1863.
132. *Galeolaria rosea* (Quatrefages 1865, as *Vermilia*, figures, + Haswell 1884, figures).
133. *Galeolaria ? tetracera* (Schmarda 1861, as *Pomatoceros*, figures) Mörch 1863.
134. *Hydroides elegans* (Haswell 1884, as *Eupomatus*, figures).
135. *Serpula jukesii* Baird 1865, figures, + Haswell 1884.
136. *Serpula vasifera* Haswell 1884, figures.
137. *Zopyrus kæmpferi* Kinberg 1866.
138. *Pomatostegus strigiceps* (Mörch 1863, as *Pomatoceros*, + McIntosh 1885, figures, + Haswell 1884, as *Vermilia*). 150 fms. Also New Zealand.

139. *Pomatostegus bowerbanki* Baird 1865, figures, + Haswell 1884.
140. *Spirobranchus rostratus* (Lamarck 1818, as *Vermilia*) Mörch 1863.
141. *Spirobranchus mörchi* (Quatrefages 1865, as *Cymospira*, + Haswell 1884).
142. *Spirobranchus brachycera* (Baird 1865, as *Cymospira*, figures, + Haswell 1884).
143. *Pomatoceros elephus* Schmarda 1861, figures, + Haswell 1884, figures.
144. *Placostegus tæniatus* (Lamarck 1818, as *Vermilia*) Mörch 1863.
145. *Ditrypa strangulata* Deshayes, figure, + Mörch 1863.
146. *Spirorbis tricostalis* Lamarck 1818, + Mörch 1863.
147. *Spirorbis lamellosus* Lamarck 1818, + Mörch 1863.
148. *Spirorbis incisus* Mörch 1863.

NEW GENERA.

The following genera, fifteen in number, are here proposed:

Paralaonome.
Type, *P. japonica* (Marenzeller 1884, as *Laonome*, figures).

Metalaonome.
Type, *M. mariæ* (Lo Bianco 1893, as *Bispira*, figures).

Dasychonopsis.
Type, *D. pallidus* sp. nov.

Parasabella.
Type, *P. media* sp. nov.

Aspeira.
Type, *A. modesta* sp. nov.

Pseudopotamilla.
Type, *P. reniformis* (Leuckart 1849, Malmgren 1867, as *Potamilla*, figures).

Schizobranchia.
Type, *S. insignis* sp. nov.

Eudistylia.
Type, *E. gigantea* sp. nov.

Metachone.
Type, *M. mollis* sp. nov.

Protoplacostegus.
Type, *P. mörchii* (McIntosh 1885, as *Placostegus*, figures).

Rhodopsis.
Type, *R. pusillus* sp. nov. (See Addendum.)

Metavermilia.
Type, *M. multicristata* (Philippi 1844, + Marenzeller 1893, as *Vermilia*, figures).

Paravermilia.
Type, *P. bermudensis* sp. nov.

Schizocraspedon.
Type, *S. furcifera* (Grube 1878, as *Hydroides*, figures).

Glossopsis.
Type, *G. minax* (Grube 1878, as *Hydroides*, figures).

SPECIES NEW TO THE REGION.

North Pacific.

Bering Sea:

1. *Spirorbis spirillum* Linné, variety *lucidus* Montagu. South to Pacific Grove, California; also Atlantic.

Alaska:

2. *Sabella elegans* sp. nov. Kadiak.
3. *Sabella humilis* sp. nov. Popof Island.
4. *Sabella leptalea* sp. nov. Kadiak.
5. *Sabella formosa* sp. nov. Berg or Glacier Bay.
6. *Parasabella media* sp. nov. Kadiak.
7. *Parasabella maculata* sp. nov. Kadiak.
8. *Aspeira modesta* sp. nov. Kadiak.
9. *Schizobranchia insignis* sp. nov. Yakutat south to Victoria, Vancouver Island, British Columbia.
10. *Schizobranchia nobilis* sp. nov. Unalaska Island to Prince William Sound.
11. *Schizobranchia concinna* sp. nov. Prince William Sound.
12. *Schizobranchia dubia* sp. nov. Prince William Sound.
13. *Schizobranchia affinis* sp. nov. Popof Island.
14. *Eudistylia gigantea* sp. nov. Prince William Sound to Yakutat.
15. *Eudistylia plumosa* sp. nov. Sitka.

16. *Eudistylia abbreviata* sp. nov. Yakutat to Sitka.
17. *Chone teres* sp. nov. Unalaska Island.
18. *Myxicola conjuncta* sp. nov. Prince William Sound.
19. *Myxicola glacialis* sp. nov. Unalaska Island.
20. *Serpula splendens* sp. nov. Prince William Sound.
21. *Crucigera formosa* sp. nov. Unalaska Island to Wrangel.
22. *Crucigera irregularis* sp. nov. Juneau.
23. *Hyalopomatopsis occidentalis* sp. nov. Prince William Sound.
24. *Spirorbis semidentatus* sp. nov. Unalaska Island to Sitka.
25. *Spirorbis variabilis* sp. nov. Sitka.
26. *Spirorbis mörchi* Levinsen. Prince William Sound to Sitka; also North Atlantic.
27. *Spirorbis incongruus* sp. nov. Prince William Sound.
28. *Spirorbis quadrangularis* Stimpson. Prince William Sound; also North Atlantic.
29. *Spirorbis lineatus* sp. nov. Prince William Sound.
30. *Spirorbis similis* sp. nov. Prince William Sound.
31. *Spirorbis violaceus* Levinsen. Prince William Sound to Sitka; also North Atlantic.
32. *Spirorbis spirillum* Linné. Loc. ? to Santa Barbara, California; also North Atlantic.
33. *Spirorbis rugatus* sp. nov. Sitka.
34. *Spirorbis asperatus* sp. nov. Prince William Sound to Pacific Grove, California.
35. *Spirorbis abnormis* sp. nov. Sitka.

Puget Sound Region:

36. *Eudistylia tenella* sp. nov. Vancouver Island, British Columbia.

California, Pacific Grove:

37. *Parasabella* sp.
38. *Pseudopotamilla debilis* sp. nov.
39. *Eudistylia intermedia* sp. nov.
40. *Metachone mollis* sp. nov.
41. *Myxicola affinis* sp. nov.
42. *Protula atypha* sp. nov.
43. *Eupomatus gracilis* sp. nov.
44. *Spirorbis eximius* sp. nov.
45. *Spirorbis comptus* sp. nov.

Mexico:

46. *Eupomatus humilis* sp. nov.

Honolulu:

47. *Dasychonopsis pallidus* sp. nov.

South Pacific.

Australia:

48. *Spirorbis inversus* sp. nov.
49. *Spirorbis tridentatus* sp. nov.

The accompanying heliotype plates are from photographs of the annelids lying under water, that they might appear as life-like as possible, a process developed by Mr. A. H. Verrill, who has also prepared for reproduction most of the camera-lucida drawings of the setæ and opercula.

I am especially indebted to Professor A. E. Verrill and Dr. W. R. Coe, of Yale University, for valuable advice and criticism, and to Mr. J. Percy Moore, of the University of Pennsylvania, for many courtesies, especially the great privilege of studying some of his North Greenland and Japanese forms.

YALE UNIVERSITY MUSEUM,
NEW HAVEN, CONNECTICUT,
January, 1904.

ANNELIDS OF THE TRIBES SABELLIDES AND SERPULIDES.

SYSTEMATIC DISCUSSION.

Tribe SABELLIDES.

Family SABELLIDÆ.

Attempts have been made by several authors to arrange the many and varied forms belonging to this group in analytical tables convenient for interpretation.

Grube (1851) placed them all in *Sabella*, dividing and subdividing the genus according to the form of the branchial lobes. Kröyer (1856) separated the northern forms into various known genera, proposing the name *Bispira* for those having the branchial lobes equal and coiled spirally: "Foruden disse fæm Grupper mener jeg, at de Sabeller, hos hvilke begge Gjællebuskene danne Spiraler, må udgjore en sjætte Slægt, hvilken man måske kunde Kalde *Bispira*."[1] He also described many new species which he referred to the genus *Sabella*. As no definite species was mentioned as type, and also as many of the species referred by him and others to the genus *Sabella* have been found to have their branchial lobes spiral or involute in retraction, it is

[1] This name *Bispira*, suggested by Kröyer (1856—*nomen nudum*), without adequate description or reference to any species, as cited above, was first used by Claparède (1870) for *Bispira volutacornis* (Rathke, 1843), supposing this to be the same as *Amphitrite volutacornis* Montagu (1804) given by Quatrefages (1865) as the first species under his genus *Distylia*, ignoring the fact that Kröyer had called attention to their being distinct. Saint-Joseph (1894), notwithstanding he mentions these facts, combines the two genera, making *volutacornis* Montagu the type of the genus *Bispira*, eliminating the *volutacornis* Rathke as it is synonymous with the *rubropunctata* Grube and referable to the genus *Jasmineira* Langerhans (1880), type *J. caudata* Langerhans. Other authors — Langerhans (1880), Lo Bianco (1893), and Johnson (1901) — have added to the confusion by applying *Bispira* to still other forms, which should be referred to as many distinct genera. It is therefore deemed desirable to restore *Distylia* for the *volutacornis* Montagu, and if *Bispira* is to be considered, it apparently should be studied in connection with its relation to *Jasmineira*.

not surprising that this name (*Bispira*) has been applied by subsequent writers to various distinct forms. Quatrefages (1865) made a careful study of all the then known genera and species, giving descriptions and some figures, also a good analytical table. He, however, ignored the name *Bispira* of Kröyer, and proposed the new genus *Distylia* for forms having the branchial lobes equal and coiled spirally, describing and figuring the (*Amphitrite*) *Sabella volutacornis* Montagu (1804) as the first species. Malmgren (1865–7) made the greatest advance toward a possible correct interpretation of the northern forms by introducing many new genera, giving excellent figures of the species, especially of the setæ, and referring most of Kröyer's new species to those already described by Sars and others. Langerhans (1884) was the first to attempt an analytical table based on the arrangement and form of the setæ. His knowledge of the genera, however, being derived largely from published descriptions and figures, which often proved inadequate, he cannot be followed with certainty. He makes no mention of *Distylia*, and places *Bispira* in his second grand division, far removed from the related genus *Spirographis*, which differs in having the branchial lobes unequal and but one spirally coiled. His conception of *Bispira* was probably suggested by Claparède, and is evidently not that of Saint-Joseph (1894). The latter author has, by studying the animals themselves, been able to correct many of the errors hitherto overlooked. He follows Langerhans in making the arrangement and form of the setæ of great importance, but finds it necessary to introduce several new genera for the reception of the various species. In his analytical table there are some misconceptions which it seems desirable to note. Under his second division the presence and position of the eyes are made a distinguishing character, whereas it often happens that species referable to the same genus may or may not possess them. The genus *Fabricia* Blainville (1828), being said to have no collar, is separated from *Oria* Quatrefages (1865), although Bourne (1883) gives a good figure showing it to possess one. The two genera *Demonax* and *Parachonia* of Kinberg are not mentioned.

A special division was necessary for the genus *Protulides*, as it was described by Webster (1884) as having avicular uncini and pennoned setæ in all the tori of the body. Numerous specimens from Bermuda, recently studied, agree perfectly with Webster's description and figures of the type species (*P. elegans*) with the exception that they have avicular uncini only in the abdominal tori. Webster states that his description is based largely on notes made on specimens from Beaufort, North Carolina. Andrews in 1891, however, in studying specimens from

Beaufort, found that they differed from Webster's description in this same character (avicular uncini only in the abdominal tori). As it is hardly possible that two species would be found in the same two localities, which differ only in the same character, it is safe to assume that the author's notes were at fault. It is therefore necessary to change this character in the descriptions of both the genus and the species. This change reveals the strong similarity between this genus and *Hypsicomus* Grube (1870) and Marenzeller (1884), *non* Ehlers (1887), the two differing but little in form and arrangement of the setæ, but the collars are distinctly unlike. In *Protulides* it is of uniform depth, like that of *Chone* and *Euchone*, and complete save the dorsal opening, while in *Hypsicomus* it has a somewhat undulating edge and ends in a ventral lobe on each side of the ventral fissure or cleft. McIntosh in his Challenger Report (1885) figures a seta and uncinus from a specimen (*Laonome hæckelii*) from St. Vincent, Cape Verde Islands, of which only the tail was found. The uncinus is given in a three-quarter view, so that it is foreshortened. The same result was noticed in mountings of the Bermuda species (*Protulides elegans*), but pressure turned the uncini, showing them in profile to have a posteriorly elongated base. Ehlers (1887) and Saint-Joseph (1894) referred McIntosh's species to *Hypsicomus;* it is, however, identical with *Protulides elegans* Webster. Notwithstanding the extended study given by Saint-Joseph and the excellent results obtained, it has been found impossible to place some of the new forms within the prescribed limits of his analytical table. This is also true of several previously described species. The genus *Eudistylia*, having equal spirally coiled branchial lobes and two kinds of dorsal thoracic setæ, should combine with *Distylia* (*Bispira*) in his division I-A-*b*, but there no eyes are mentioned, and the dorsal setæ in the type (*D. volutacornis*) are superior 'limbate,' inferior 'cimeter' shaped, the latter commencing on the fifth segment, while in the present form the inferior ones are spatulate back of the collar fascicle, similar to those found in *Pseudopotamilla reniformis*, as figured by Malmgren (1867). This species has, however, simple branchial lobes, and is placed in his second division under *Potamilla*.

In my studies it has appeared impractical to place too much importance on the kinds of setæ alone, as the same forms are repeated in so many different genera. It has seemed desirable to give more consideration to the form of the branchial lobes and the branchiæ themselves. In all the typical *Sabellas* studied the rachises of the branchiæ are distinctly four-sided, connected along their posterior portions by a deli-

cate membrane or web; in the *Parasabellas* these change to less distinguishable four-sided ones, and the web is but slightly developed or disappears, while in the *Eudistylias* they become distinctly three-sided, rounded outwardly. They may also be simple, or many times divided or split, as in the *Schizobranchias*.

It has also been found that, although so many valuable facts have been so comprehensively presented by Saint-Joseph, there are still some genera of which little is known, owing principally to the too broad application by their authors, as evinced by the variety of forms referred to them. This confusion has been greatly increased by subsequent writers, none having restricted the genera to any one of the species as a type, nor published figures as an aid toward a possible correct interpretation. This is especially true of the genera *Sabellastarte* and *Demonax*.

Sabellastarte was proposed by Savigny (1809) as a group or divisional name for Sabella-like forms having the branchiæ arranged in a double series. It was adopted as such by Grube and Quatrefages, but Saint-Joseph, following Kröyer, used it as a generic name, without presenting any additional facts in regard to the branchial lobes, form of the collar, or form and arrangement of the setæ. The two species — *Sabella indica* Savigny and *Sabella magnifica* Shaw — apparently agree only in having very long and numerous branchiæ arranged in a double series. The numerous figures given by Shaw show an interesting and easily noted character, *i. e.*, the absence of pinnæ on the slender banded rachises. Neither Quatrefages (1865) nor Marenzeller (1884) mentions such a peculiarity as belonging to *S. indica*, thus giving emphasis to the small importance of the arrangement of the branchiæ as the *only* generic character.

Marenzeller describes *S. indica* as having from 60 to 84 (in different individuals) very long branchiæ arranged in a double series, and equal to about half the entire length of the body, which consists of from 196 to 227 segments and measures from 80 to 135 mm. in length. Quatrefages gives the setæ as lanceolate in form, avicular uncini only in the tori and the collar as four-lobed. It is proposed to restrict the genus to this species as type. The genus *Eurato* Saint-Joseph (1894) differs in not having the branchiæ arranged in a double series. Seven species are included in this *without* mentioning any special one for a type.

Kinberg (1866) placed five species in his genus *Demonax*, the first (*D. krusensterni*) and the last (*D. cooki*) being the only two that from the descriptions appear to be at all alike. Therefore the

genus is restricted to these two species, with the first taken as type. But, as no figures have been given, we can form no definite conception of the form and arrangement of the setæ or of other important features, showing the great need of a more careful study of these species.

In constructing the following analytical table for the genera which are related to the genus *Sabella*, an attempt has been made to base it on characters which can be readily seen with the aid of a good pocket lens, the tables hitherto published being so complicated as to require much careful microscopic work before one can arrive at the generic relation of any species.

In studying the various forms representing the numerous genera, certain details in structure are found to be repeated a certain number of times, forming a definite sequence or continuous evolution, as in the development of the collar.

Taking the form without a collar as the primitive type, the anterior edge of the first segment becomes more or less elongated in front, forming one or two more or less conspicuous lobes. When a collar begins to develop, the entire anterior edge may be produced into a free margin without any openings; or one incision or cleft may occur, forming an opening on the back, the ends being in contact or meeting; or only a portion along the sides and in front may be produced, forming a collar open on the back with widely separated ends. The same process of development taking place in the anterior margin of the first segment of the two-lobed type will produce a two-lobed collar, either with ends in contact or separated on the back. When additional incisions or clefts develop on the sides of either of these two-lobed forms, two corresponding four-lobed collars are formed, those with separated ends usually having the lateral incisions toward the front (ventro-lateral), while in those where the ends are in contact the incisions are toward the back (dorso-lateral). It therefore seems desirable to use the collar as an important character in grouping the genera. Other characters also of these primitive forms are found to be repeated; the setæ and uncini especially, or variations of them, being repeated many times in various combinations which can be arranged in definite groups.

It will be found that the concise facts in regard to many of the 36 genera cited are much too meager to render it possible for one to place each genus in its exact or correct relative position. There is still much work to be accomplished before a perfect analytical table can be formulated.

ANALYTICAL TABLE FOR SABELLA AND RELATED GENERA.

1. **Collar absent** ..... 2.

1′. **Collar present** ..... 3.

2. **Anterior edge of first segment produced in front, forming a small angular ventral lobe.**

Uncini in tori on abdomen; beaked setæ in tori on thorax.

(1) MYXICOLA (Koch 1846) Grube 1855 + Malmgren 1865, including *Leptochone* Claparède 1870, *teste* Marenzeller 1893.

Type, *M. infundibulum* (Montagu 1808, figures) Koch 1846 + Saint-Joseph 1898, figures. Greenland.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, lanceolate in form, *i. e.*, tapered, more or less elongated, widest near lower end of blade. Uncini similar in form to those of *Leucariste* Malmgren 1865 (Terebellacea). Ventral setæ on thorax with broadened curved (beaked) end, more or less serrate on top, on a long, nearly straight shaft or manubrium, similar to those of *Terebellides*.

2′. **Anterior edge of first segment produced in front, forming two long, pointed, ventral lobes.**

Uncini in tori on abdomen; uncini and pennoned setæ in tori on thorax.

(2) AMPHIGLENA Claparède 1864.

Type, *A. armandi* Claparède 1864, figures, = *A. mediterranea* (Leydig 1851) Claparède 1864 + Langerhans 1880, figures, + Bourne 1883, figures, + Saint-Joseph 1894, figures. Gulf of Naples.

Branchiæ free. Inferior setæ on thorax, below collar fascicle, lanceolate in form. Uncini avicular in form, those on the thorax the larger.

3. **Collar entire, without incisions or clefts.**

Pectinate setæ in tori on abdomen; beaked setæ in tori on thorax.

(3) HAPLOBRANCHUS Bourne 1883.

Type, *H. aestuarius* Bourne 1883, figures. Coast of Isle of Sheppey, England, and mouth of Liffey, Ireland.

Branchial lobes small, bearing *few* ciliated (without pinnæ) branchiæ; one eye on ventral surface of each lobe, beneath collar. Inferior setæ on thorax, below collar fascicle, lanceolate in form. Setæ in thoracic tori approaching the form found in *Trichobranchus* Malmgren 1865 (Terebellacea); setæ in abdominal tori with laterally serrate broadened end, on long shaft or manubrium, approaching that in *Lagis* Malmgren 1867 (Amphictenea) with the elongated base of that form turned downward as a shaft or manubrium.

(4) MANAYUNKIA Leidy 1858 and 1884.

Type, *M. speciosa* Leidy 1858 and 1884, figures. Schuylkill River at Philadelphia, Pennsylvania, and Egg Harbor River, New Jersey.

Branchial lobes laterally elongated, bearing *numerous* ciliated (without pinnæ) branchiæ; 7 eye-spots on each lobe. Young resembling *Haplobranchus*. Setæ somewhat resembling those of *Haplobranchus*.

3′. **Collar open on back, either with or without incisions or clefts** ..... 4.

4. **Collar open on back, without incisions or clefts (one-lobed)** ..... 5.

4′. Collar open on back, with one or more incisions or clefts..... 6.

5. Collar with ends separated on back.

Pectinate setæ in tori on abdomen; beaked setæ in tori on thorax.

(5) Fabricia Blainville 1828.[1]

Type, *F. fabricii* (Müller) Fabricius 1780, figure. Greenland.

Branchial lobes small, bearing few branchiæ with unequal, more or less alternating, pinnæ. Setæ similar to those of *Manayunkia*.

Uncini in tori on abdomen; beaked setæ in tori on thorax.

(6) Oria Quatrefages 1865 + Claparède 1870.

Type, *O. armandi* (Claparède 1874, figures) Quatrefages 1865 + Claparède 1870 + Langerhans 1880, figures, + Saint-Joseph 1894, figures. Gulf of Naples.

Branchial lobes with branchiæ similar to those of *Fabricia*. Setæ also similar to those of *Fabricia*. Uncini somewhat similar in form to those of *Ampharete* or *Amphicteis* Malmgren 1865 (Ampharetea).

(7) Oriopsis Caullery and Mesnil 1896.[2]

Type, *O. metchnikowi* Caullery and Mesnil 1896, figures. St. Vaast-la-Hougue, northern coast of France.

Branchial lobes small, bearing few branchiæ. Inferior setæ on thorax, below collar fascicle, lanceolate in form. Beaked setæ somewhat similar in form to those in *Jasmineira*. Uncini somewhat similar in form to those of *Artacama* Malmgren 1865 (Terebellacea), with more numerous teeth.

Uncini only in tori on both abdomen and thorax.

(8) Eurato Saint-Joseph 1894 (restricted).

Type, *E. pyrrhogaster* (Grube 1878,[3] figures) Saint-Joseph 1894, as first species. Philippine Islands.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, 'suboval' in form. Uncini avicular in form.

5′. Collar with ends meeting, or in contact on back.

Uncini in tori on abdomen; beaked setæ in tori on thorax.

(9) Chone Kröyer 1856.

Type, *C. infundibuliformis* Kröyer 1856 + Malmgren 1865, figures, and 1867, figure. Spitzbergen.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, spatulate in form, *i. e.*, short, rounded, widest in middle or near upper end.

(10) Megachone Johnson 1901.

Type, *M. aurantiaca* Johnson 1901, figures. Puget Sound.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, lanceolate in form. Uncini similar to, or approaching

[1] Good figures are given by Bourne 1883 and Leidy 1884.

[2] Although the collar is described as rudimentary or wanting, and no figures are given, this genus is placed here conditionally, as it is said to possess some characters similar to those in *Oria*.

[3] The collar is neither described nor figured with sufficient exactness for one to determine its true character.

the form of those in *Chone*. Intermediate between those of *Chone* and *Euchone*.

(11) EUCHONE Malmgren 1865.

Type, *E. analis* (Kröyer 1856) Malmgren 1865, figures, as first species. Spitzbergen.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, subspatulate in form, *i. e.*, short, tapered, widest in middle. With caudal sucker.

(12) METACHONE gen. nov. (See p. 216.)

Type, *M. mollis* sp. nov., figures. Pacific Grove, California.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, clavate in form, *i. e.*, long, rounded, widest near upper end. Uncini similar in form to those of *Euchone*. Without caudal sucker.

(13) PARACHONIA Kinberg 1866.[1]

Type, *P. letterstedti* Kinberg 1866. Cape of Good Hope.

Branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, clavate in form. Uncini unknown.

(14) JASMINEIRA Langerhans 1880.

Type, *J. caudata* Langerhans 1880, figures. Madeira.

Branchiæ free. Inferior setæ on thorax, below collar fascicle, subspatulate in form. Uncini avicular in form.

(15) DIALYCHONE Claparède 1870.

Type, *D. acustica* Claparède 1870, figures. Gulf of Naples.

Branchiæ free. Inferior setæ on thorax, below collar fascicle, clavate in form. Uncini somewhat similar in form to those of *Sabellides* Malmgren 1865 (Ampharetea), with smaller and more numerous teeth, the lowest one larger than the others.

Avicular uncini in tori on abdomen; avicular uncini and pennoned setæ in tori on thorax.

(16) PROTULIDES Webster 1884.

Type, *P. elegans* Webster 1884, figures. Beaufort, North Carolina, and Bermuda. See p. 184.

Branchiæ joined by membranous web. Setæ on collar in a dorsal, oblique, linear series on each side. Inferior setæ on thorax, below collar fascicle, suborbicular in form.

6. **Collar with only one incision or cleft (two-lobed)** ..... 7.

6′. **Collar with three incisions or clefts (four-lobed)** ..... 8.

7. **Collar with ends separated on back.**

Uncini only in tori on both thorax and abdomen.

(17) LAONOME Malmgren 1865, *non* Kinberg 1866 *nec* Marenzeller 1884.

Type, *L. kröyeri* Malmgren 1865, figures. Spitzbergen.

Branchiæ free. Inferior setæ on thorax, below collar fascicle, orbicular in form. Uncini similar in form to those of *Euchone*.

[1] A thorough knowledge of this genus may render it necessary to combine it with the preceding (*Metachone*).

(18) DEMONAX Kinberg 1866 (restricted).[1] (See p. 186.)

Type, *D. krusensterni* Kinberg 1866. Honolulu.

Branchiæ free, without outer appendages. Inferior setæ on thorax, below collar fascicle, lanceolate in form.

(19) DASYCHONOPSIS gen. nov. (See p. 198.)

Type, *D. pallidus* sp. nov., figures. Honolulu.

Branchial lobes small, not spiral; branchiæ free, with outer appendages. Inferior setæ on thorax, below collar fascicle, lanceolate in form. Avicular uncini in tori on abdomen; avicular uncini and pennoned setæ in tori on thorax.

(20) BRANCHIOMMA (Kölliker 1858) Claparède 1870.

Type, *B. vesiculosum* (Montagu 1815, figures) Claparède 1870, figures, + Langerhans 1884, figures + Saint-Joseph 1894, figures. Kingsbridge, south coast of Devonshire, England.

Branchiæ free; eyes subterminal. Inferior setæ on thorax, below collar fascicle, oblanceolate in form, *i. e.*, tapered, widest in middle, differing in length.

(21) PARASABELLA gen. nov. (*Potamilla* Malmgren 1865, in part, + Marenzeller 1884, in part). (See p. 199.)

Type, *P. media* sp. nov., figures. Alaska.

Branchiæ joined by a small membranous web; eyes, when present, on outer surface of the rachises. Inferior setæ on thorax, below collar fascicle, oblanceolate in form.

7′. Collar with ends meeting or in contact on back.

Avicular uncini only in tori on both thorax and abdomen.

(22) PARALAONOME gen. nov. (*Laonome* Kinberg 1866 and Marenzeller 1884.) (See p. 197.)

Type, *P. japonica* (Marenzeller 1884, figures). Japan.

Branchial lobes forming equal spirals. Inferior setæ on thorax, below collar fascicle, lanceolate in form.

(23) NOTAULAX Tauber 1879 + Levinsen 1883 (revised).

Type, *Notaulax* sp. Tauber 1879 = *N. rectangulatus* Levinsen 1883, figures.

Branchiæ free. Setæ on collar in dorsal, angular, linear series on each side. Inferior setæ on thorax, below collar fascicle, spatulate in form. Avicular uncini in tori on abdomen; avicular uncini and pennoned setæ in tori on thorax.

(24) HYPSICOMUS Grube 1870 + Marenzeller 1884, *non* Ehlers 1887.

Type, *H. stichophthalmos* Grube 1863, figure, as first species. Adriatic Sea.

Branchiæ joined by membranous web. Setæ on collar in dorsal, oblique, linear series on each side. Inferior setæ on thorax, below collar fascicle, 'broad oval' in form.

[1] At the present time very little is definitely known of this genus.

(25) POTAMILLA Malmgren 1865 (restricted).

Type, *P. neglecta* (Sars 1861) Malmgren 1865, figures, as first species. Off Finmark, in 20–40 fms.

Branchiæ free. Inferior setæ on thorax, below collar fascicle, subspatulate in form, *i. e.*, short, tapered, widest in middle.

(26) ASPEIRA gen. nov. (*Potamilla* Malmgren 1865, in part). (See p. 202.)

Type, *A. modesta* sp. nov., figures. Alaska.

Branchiæ free. Inferior setæ on thorax, below collar fascicle, subspatulate to oblanceolate in form, *i. e.*, tapered, widest in middle, varying in length.

8. Collar with ends separated on back.

Incisions or clefts ventro-lateral and ventral.

Avicular uncini only in tori on both abdomen and thorax.

(27) SABELLASTARTE Savigny 1809 + Saint-Joseph 1894. (See p. 186.)

Type, *S. indica* Savigny 1809, as first species, + Quatrefages 1865. Indian Ocean.

Branchial lobes comparatively small, spiral only in retraction. Inferior setæ on thorax, below collar fascicle, lanceolate in form. Uncini similar to those of *Pseudopotamilla*.

(28) METALAONOME gen. nov.

Type, *M. mariæ* (Lo Bianco 1893, as *Bispira*, figures). Gulf of Naples. Branchial lobes spiral only in retraction. Inferior setæ on thorax, below collar fascicle, oblanceolate in form.

(29) DASYCHONE Sars 1861 + Malmgren 1865 (restricted).

Type, *D. decora* Sars 1861, as first species, = ? *D. infarcta* (Kröyer 1856) Malmgren 1865, figures. Coast of Norway.

Branchial lobes forming equal spirals; branchiæ with outer appendages. Inferior setæ on thorax, below collar fascicle, lanceolate in form.

Avicular uncini in tori on abdomen; avicular uncini and pennoned setæ in tori on thorax.

(30) SABELLA (Linné) Malmgren 1865.

Type, *S. pavonina* Savigny 1809 + Malmgren 1865, figures, as first species. Coast of Norway, in 30–100 fms.

Branchial lobes spiral only in retraction; branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, lanceolate in form.

(31) DISTYLIA Quatrefages 1865 (*Bispira* Saint-Joseph 1894). (See p. 183.)

Type, *D. volutacornis* (Montagu 1804, figures) Quatrefages 1865, figures. South coast of Devonshire, England.

Branchial lobes forming equal spirals. Inferior setæ on thorax, below collar fascicle, lanceolate in form.

(32) SPIROGRAPHIS Viviani 1805.

Type, *S. spallanzanii* Viviani 1805, figures, + Claparède 1870, figures, + Saint-Joseph 1898. Gulf of Naples.

Branchial lobes forming unequal spirals; branchiæ joined by membranous web. Inferior setæ on thorax, below collar fascicle, lanceolate in form.

8′. **Collar with ends meeting or in contact on back.**

Incisions or clefts dorso-lateral and ventral.

Avicular uncini in tori on abdomen; avicular uncini and pennoned setæ in tori on thorax.

(33) POTAMIS Ehlers 1887.

Type, *P. spathiferus* Ehlers 1887, figures. Off the coast of Florida, in 275 fms.

Branchial lobes small; branchiæ free, unequal. Inferior setæ on thorax, below collar fascicle, orbicular in form. Avicular uncini on thorax in form intermediate between those of *Jasmineira* (as in *J. oculata* Langerhans 1884) and those of *Pseudopotamilla* (as in *P. oculifera* Leidy 1855).

(34) PSEUDOPOTAMILLA gen. nov. (*Potamilla* Malmgren 1865, in part). (See p. 203.)

Type, *P. reniformis* (Leuckart 1849, figures, + Malmgren 1867, figures). Iceland.

Branchial lobes small; branchiæ simple, free, equal. Inferior setæ on thorax, below collar fascicle, spatulate in form.

(35) SCHIZOBRANCHIA gen. nov. (See p. 205.)

Type, *S. insignis* sp. nov., figures. Alaska.

Branchial lobes small; branchiæ free, divided. Setæ similar in form to those of *Pseudopotamilla*.

(36) EUDISTYLIA gen. nov. (See p. 209.)

Type, *E. gigantea* sp. nov., figures. Alaska.

Branchial lobes produced ventrally, forming equal spirals; branchiæ in nearly uniform double series. Setæ similar to those of *Pseudopotamilla*, *i. e.*, inferior setæ on thorax, below collar fascicle, spatulate in form.

Genus **Sabella** Malmgren 1865.

Type, *Sabella pavonina* Savigny.

In this genus the branchial lobes are small at base, free and more or less prolonged ventrally, spirally coiled or involute in retraction, more or less flaring when fully expanded.

The branchiæ are nearly equal in length, arranged in a single series, their rachises four-sided, being flattened on the back, the two outer angles furnished with thin membranous edges, most developed and sometimes ruffled along their anterior or distal portions, where they frequently fold outward, toward each other, forming a conspicuous groove. The two inner edges bear slender, more or less crowded pinnæ which do not extend to the end, leaving a thin, flattened, more or less bluntly rounded tip. They are connected along their posterior or proximal portions by a more or less developed, thin, interbranchial membrane or web. Eyes usually present, arranged in pairs on the back, often concealed by color spots.

Collar four-lobed, circular, with a slightly undulating rolling edge, the lateral slits in front of the fascicles of setæ, or ventro-lateral, often marked by a spot of color; ventral lobes small; dorsal lobes wanting, the ends widely separated on the back, showing the cephalic region with a deep median furrow defined by a conspicuous ridge on each side. Inside the collar, opposite the ventral fissure, is a small, triangular, median, somewhat bilobed cephalic swelling, often with two conspicuous spots of color, bordered by a thin, often ruffled membrane. Extending inward from this, along the base of each branchial lobe, is a thin, moderately developed, often much ruffled membrane, which, folding on itself, terminates at the ventral end of the lobe. Mouth protected on each side by a moderately developed membranous lobe supporting a very long, conspicuous, regularly tapered dorsal tentacle.

Fascicles of setæ forming oblique series on the thorax, of two forms, the superior ones linear, the inferior round and protected by an auriform membrane; those on the abdomen comma-shaped.

All the setæ limbate, of one form, long, regularly tapered, lanceolate, the two equal sides, seen only in a direct front or back view, appearing as a single border, as given by Malmgren in a direct profile view; varying in width, the superior ones much narrower than the inferior and fewer in number; on the abdomen they are less regularly tapered. Along the tori on the thorax are two forms, avicular hooks and pennant-bearing or pennoned[1] setæ; on the abdomen avicular hooks only.

A typical example of the type (*Sabella pavonina* Savigny 1809) has not been seen. The above description refers to forms like *Sabella crassicornis* Sars (1851).

Sabella melanostigma Schmarda (1861), given by Ehlers (1887) as a typical example of his interpretation of this genus, Saint-Joseph (1894) placed in his new genus *Eurato*, under the second group in his analytical table, for genera having avicular hooks only in the thoracic tori. Treadwell (1901) recorded this species from Porto Rico.

SABELLA ELEGANS sp. nov.

Pl. XXVI, fig. 2; Pl. XXVII, fig. 6*c*; Pl. XXXIII, figs. 20, 21; Pl. XXXIV, figs. 1, 4, 5, 10; Pl. XXXVII, figs. 12, 33.

Type locality. — Kadiak.

[1] These setæ of the tori have the exposed end of the long shaft or manubrium expanded into a short, more or less cordate-shaped, usually striated portion, bearing a long transparent, flexible, pennant-like terminal portion. 'Cucullate,' 'mucronate,' 'en pioche,' and other terms have been used as descriptive of them.

Color white, with the branchiæ tinged with pink and conspicuously spotted with dark purple, forming bands.

Number of segments about 80, of which 8 belong to the thorax.

The branchiæ number about 22 in each lobe, not counting the 3 or 4 small ones at the lower or ventral end. They are about 16 mm. long, broad and flat on the back, with the membranous edges ruffled and very conspicuously developed along their distal portions.

Eyes in pairs, situated in the color spots, so that they are not readily found.

Length of figured specimen 2.25 inches; breadth at base of collar about 7.5 mm.; length of thorax along setæ 7 mm.

Kadiak, July 3, four specimens.

This species closely resembles *Sabella crassicornis* Sars, as figured by Malmgren (1865), but has more numerous branchiæ and color spots. It is easily distinguished from the other species of this region by the regular arrangement of the color spots on the rachises and the extending of the color onto the pinnæ, which is unusual.

SABELLA HUMILIS sp. nov.

Pl. XXVII, fig. 2; Pl. XXXVI, figs. 4–11.

Type locality. — Popof Island.

Compared with the smallest specimen of *S. elegans*, which has about 50 segments (7 on the thorax) in a length of 15 mm. and a breadth of about 2.5 mm., this species is shorter, having 55 segments (8 on the thorax) in a length of 11 mm. and breadth of 2 mm.

The branchiæ, though of similar form, length, and number (12 pairs), have the basal membrane more developed and but three series of unequal-sized spots of color, on most of which a pair of eyes is situated, while the former has six series of color spots of about equal size, and regular in arrangement. There is also a noticeable contrast between the prevailing colors — deep crimson in the present species, and pale yellowish white in *S. elegans*.

The tube is thin, horn-color, with a coating of very fine grey sand.

Popof Island, July 8, one specimen, dredged.

SABELLA LEPTALEA sp. nov.

Pl. XXVII, fig. 6*a*; Pl. XXXIII, figs. 5, 14, 27, 29; Pl. XXXIV, figs. 6–9, 22.

Type locality. — Kadiak.

In form and coloring this species closely resembles *S. formosa* and *S. elegans*, but differs in having the pinnæ of the branchiæ fewer, shorter, and exceedingly delicate.

There are about 90 segments in the largest specimen, of which 8 belong to the thoracic region.

Branchial lobes small, considerably developed ventrally, each bearing about 22 rather long branchiæ, which are connected by a basal membrane; the rachises taper gradually toward the extremity, which often bears a short, very delicate terminal filament; their two thin outer edges are considerably developed and turn outward, especially near the tip; their pinnæ are moderately long, exceedingly slender, and gradually decrease in length.

Eyes single or in pairs on nearly all of the brown color spots, which number from 5 to 8 on different branchiæ.

Length 75 mm.; breadth at base of thorax 10 mm.; length of thorax along setæ about 11 mm.; length of branchiæ about 19 mm.

Kadiak, July 3, three ♀ specimens.

One specimen was taken from its tube, which is very thin and flexible, of a dark purplish brown color, with a coating of very fine gray sand.

SABELLA FORMOSA sp. nov.

Pl. XXVII, fig 6*b*; Pl. XXXIII, fig. 32; Pl. XXXIV, figs. 14, 21; Pl. XXXV, figs. 7, 25, 30; Pl. XXXVI, figs. 25, 32.

Type locality. — Berg or Glacier Bay.

A large species, similar in size and form to *S. leptalea*, of a beautiful pink color, the branchiæ of a deeper shade, with large brown spots varying in number from 3 to 7 and not evenly spaced, as in *S. elegans*.

In the largest specimen, which is distended with eggs and not very well preserved, there are about 70 segments, of which 8 belong to the thorax.

The branchial lobes arch well forward ventrally, the free portion forming noticeable spirals when unexpanded. The branchiæ, about 29 in each lobe, not counting 4 or 5 undeveloped ventral ones, are comparatively long and slender, with closely crowded, very long and slender pinnæ, which decrease abruptly, leaving relatively short thin ends. Eyes of good size, arranged in pairs on some but not all of the brown spots.

Collar simply rounded at the ventral fissure, without angular lobes, often with spots of brown at the bases of the noticeable lateral clefts.

Length of largest specimen about 100 mm.; branchiæ 23 mm.; breadth at base of thorax about 10 mm. Length of smallest specimen about 47 mm.; breadth about 7 mm.

Berg or Glacier Bay, June 10, four specimens, dredged.

Tubes thin and flexible; brown, with a tinge of pink; joined to each other, covered with exceedingly fine gray sand, to which delicate hydroids are attached.

This is readily distinguished from the other allied forms by the more numerous branchiæ, with their very long crowded pinnæ and irregularly arranged brown spots.

SABELLA (?) VANCOUVERI Kinberg.

Sabella vancouveri KINBERG, Annulata nova, p. 353, 1866.

Type locality. — Vancouver Island, British Columbia.

Nothing corresponding to this species occurs in the present collection.

It was described by Kinberg (1866) as having a stout body; 8 or 9? thoracic segments; 182 branchiæ on both sides, 18–23 mm. long, with 5 purple bands; setæ limbate, hastate; uncini; length of the 36 anterior segments, 60 mm.

No mention is made of the form of the branchial lobes, yet the large number of branchiæ make it improbable that the species can be a typical *Sabella*. No species of *Eudistylia*, however, has more than 3 bands of color on the branchiæ, and those of *Schizobranchia* are not banded.

Genus **Paralaonome** nov.

Type, *Laonome japonica* Marenzeller.

The above species was erroneously referred by Marenzeller to the genus *Laonome* of Malmgren (1865), agreeing with *L. kröyeri* Malmgren, the type, only in having a single series of avicular uncini in all the tori; these differ greatly in form, however, being distinctly prolonged posteriorly, not truncated as in Malmgren's species.

The branchial lobes are large, prolonged ventrally, spirally coiled in retraction, as in *Sabella*, and bear numerous branchiæ arranged in a double series.

The narrow four-lobed collar differs, also, from the much more conspicuous two-lobed one on *L. kröyeri*.

Paralaonome is therefore proposed for the reception of the Japanese species, notwithstanding the fact that Saint-Joseph (1894) suggested that it should be referred to the genus *Sabellastarte* Savigny (1809), type *S. indica* Savigny (1809), although it does not appear to agree very closely with the other species placed there.

Laonome antarctica Kinberg (1866) from the Straits of Magellan may prove to be a related species.

PARALAONOME JAPONICA (Marenzeller).

Laonome japonica MARENZELLER, Südjapanische Anneliden, p. 212, pl. III, figs. 4 (A–C), 1884.
Sabellastarte japonica SAINT-JOSEPH, Annélides de Dinard, p. 249, 1894.

Type locality. — Japan.

Branchial lobes much prolonged ventrally, and spirally coiled in retraction, possibly unrolled in expansion, bearing 100 to 110 or more moderately long branchiæ arranged in two series, their wine-colored rachises slender, four-sided, the two inner edges with closely crowded yellowish pinnæ. Eyes, if present, not discernible.

Collar inconspicuous, four-lobed, the dorso-lateral incisions forming small dorsal lobes separated by a deep furrow; at the ventral fissure simply rounded without angular ends.

Number of segments about 200, of which 8 belong to the thorax, on which the fascicles of setæ, which are circular in form as in *Sabella*, form very oblique series.

Setæ on all of the segments long, regularly tapered, of two forms, narrow and broad. Avicular uncini only in all the tori.

Length, without the branchiæ, of a much contracted specimen 70 mm.; breadth 10 mm.

The above characters are taken from a specimen in the Yale University Museum, and agree well with those given by Marenzeller, differing only in size and number of branchiæ, stated by him to be 144.

Genus **Dasychone** Sars 1861.

Type, *Dasychone decora* Sars = ? *Dasychone infarcta* (Kröyer 1856) Malmgren 1865.

The various species which have been referred to this genus vary so greatly in the size and form of the branchial lobes, the size and arrangement of the outer branchial processes, also the form of the collar, that they need much careful study and separation, probably resulting in the further division of the genus (see p. 192).

Genus **Dasychonopsis** nov.

Dasychone MALMGREN 1865, in part.

Type, *Dasychonopsis pallidus* sp. nov.

The type (*D. pallidus*), in its small (not spiral) branchial lobes and bilobed collar, agrees with *Dasychone argus* Sars, as figured by Malmgren (1865). Both are unlike *D. infarcta* (Kröyer), supposed to be identical with *D. decora*, given by Sars in 1861 as his first species and therefore taken as the type of the genus *Dasychone*. This has the

branchial lobes much prolonged ventrally, and spirally coiled, and the collar distinctly four-lobed, with conspicuous ventro-lateral and ventral incisions. The name *Dasychonopsis* is therefore proposed for *D. pallidus* sp. nov., as type. *D. compressa* Ehlers (1887) and *D. curta* Ehlers (1901) are related species.

DASYCHONOPSIS PALLIDUS sp. nov.

Type locality. — Honolulu.

A small nearly colorless species, with long slender branchiæ about one half as long as body, a little rust color on the branchial lobes and minute darker dots at the outer end of each torus.

Branchial lobes small, not prolonged ventrally, neither spiral nor involute, bearing 9 pairs (18) of branchiæ having slender four-sided rachises, with moderately long, delicate, tapered tips, often curled inward, connected posteriorly by a shallow inconspicuous membrane; slender, well-separated pinnæ along their two inner edges, and comparatively stout tapered processes, forming 5 to 8 pairs, situated at regular intervals along the two outer ones; between the processes a pair of yellowish brown eyes often occur; at the edge of the interbranchial membrane a single long, slender process, turning outward, arises from the dorsal outer edge of each rachis.

Collar two-lobed, without lateral incisions, of nearly uniform depth, arising abruptly just above the dorsal setæ, widely separated, ending in angular ventral flaps.

Number of segments 18, of which 5 belong to the thorax, on which the small circular fascicles of setæ form oblique series.

Collar setæ long, regularly tapered, of two forms, narrow and broad; on the other thoracic segments broad ones only; on the abdomen they are of two forms, similar to those on the collar but much longer; uncini only in all the tori, those on the abdomen with more numerous apical teeth.

Entire length 7.5 mm.; branchiæ about 4 mm.

Kinberg (1866) described *Sabella havaica* from Honolulu as having the outer processes on the branchiæ, characteristic of *Dasychone*. Although similar in size (8 mm.) to the present species, it has 13 branchiæ and 44 segments.

Genus **Parasabella** nov.

Type, *Parasabella media* sp. nov.

This generic name is proposed for species which, though resembling typical Sabellas in form, have the branchial lobes small, but slightly

prolonged ventrally, with the branchiæ not so distinctly four-sided, and connected by a very slightly developed, posterior, interbranchial, membranous web. The collar bilobed, without lateral incisions, widely separated on the back, ending in more or less angular ventral ends.

All the fascicles of setæ laterally elongated.

Setæ on the thorax of two forms; superior ones long, regularly tapered; inferior ones shorter, broader, and oblanceolate. Tori with avicular uncini and pennoned setæ.

Sabella microphthalma Verrill (1874) from the southern coast of New England is a *Parasabella*.

PARASABELLA MEDIA sp. nov.

Pl. xxvii, figs. 3–5; Pl. xxxiii, figs. 34–36; Pl. xxxiv, fig. 3; Pl. xxxvi, figs. 13, 14; Pl. xxxvii, fig. 30.

Type locality. — Kadiak.

This small species is short and stout, abruptly tapered near the broad posterior end, light brown in color, tinged with crimson, with the branchiæ variously spotted with dark brown.

Segments about 100 in the largest example, of which 8 belong to the thorax, on which the fascicles of setæ form oblique series.

Branchial lobes but slightly prolonged ventrally, bearing about 18 pairs of long, rather slender, much curled and twisted branchiæ; their rachises not so distinctly four-sided as in *Sabella*, and not connected by a noticeable basal membrane or web; pinnæ short, but little developed, leaving long tapered ends. The irregular development of the pinnæ and the curling of the branchiæ are largely, if not entirely, due to the presence of a curious parasite which attaches itself to, and develops in masses along, the thin inner membranous edges of the rachises. These masses are protected by a thin transparent wall. Eyes none; not discernible in preserved specimens.

Collar well developed, without lateral incisions, open on the back, arising abruptly midway between the broad dorsal furrow and the first fascicle of setæ, ending in small, angular, ventral lobes.

Setæ characteristic of the genus, with the exception of the pennoned ones of the thoracic tori, which have one side larger than the other, and developed into a long, slender, terminal filament, which is separated or split at its base, from the pointed end of the shaft or manubrium.

Length of largest specimen about 35 mm.; breadth at base of thorax about 5 mm.; at base of collar 4 mm.; length of thorax along setæ about 5.5 mm. Length of smallest specimens 19 mm.; breadth at base of thorax about 4 mm.

Kadiak, July 3, several specimens. Their tubes, which are semi-transparent, horn color, with more or less foreign matter adhering in patches, are attached in clusters or colonies.

PARASABELLA MACULATA sp. nov.

PL. XXVIII, figs. 8, 9; PL. XXXIII, figs. 8, 12, 33; PL. XXXIV, fig. 2; PL. XXXVI, figs. 12, 15, 16, 21, 22.

Type locality. — Kadiak.

A rather long, slender species, yellowish white, with the branchiæ irregularly spotted with brown, each rachis having its two outer edges marked by dashes and spots of dark chocolate brown, and the pinnæ banded with a lighter shade.

Segments rather long and well defined, about 70 in number, of which 8 belong to the thorax, where the fascicles of setæ are in nearly straight series.

Branchiæ about 14 pairs; not joined by a basal web, narrow, without noticeably thinner edges; the pinnæ of moderate length, gradually decreasing toward the end, leaving a comparatively long, rounded, tapered, naked terminal portion.

Eyes not discernible.

Collar well developed, round, of nearly uniform depth, arising abruptly a little above the dorsal fascicles of setæ, and ending in two small ventral lobes.

Oral membrane conspicuous, tentacles long, broad at base, with an opaque, rib-like median portion tapering into the long slender end.

Dorsal furrow conspicuous on the first three segments.

Length about 35 mm.; branchiæ about 10 mm.; breadth at base of thorax 3.5 mm.

Kadiak, July 3, one specimen.

Although so very dissimilar in general appearance, this species is very much like the preceding in the coloring of the branchiæ and form of most of the setæ, but those of the tori do not appear to have the conspicuous split seen in that species (PL. XXXVII, fig. 30).

PARASABELLA sp.

Type locality. — Pacific Grove, California.

A very small colorless specimen, destitute of branchial lobes, has the round bilobed collar and form of setæ characteristic of this genus.

It has 8 thoracic and 50 abdominal segments.

Length 12 mm.; of thorax 3 mm.; breadth 2 mm.

Genus Aspeira nov.

Type, *Aspeira modesta* sp. nov.

Branchial lobes with small basal attachment, not spiral, without ventral prolongation, and united dorsally, bearing a single series of moderately long, simple plumose branchiæ of about equal length, their rachises rounded on the back and, along the two inner edges, having a conspicuous ruffled membrane, most developed posteriorly, outside of which the long, rather coarse, well-separated (especially posteriorly) pinnæ arise; these extend nearly to the end of the rachis, leaving but a very small tapered tip. Eyes none.

Collar bilobed, as in *Potamilla*, arising from the dorsal furrow and continuing in an unbroken curve to the ventral fissure, where it abruptly expands into long, narrow, triangular processes, twisted strongly backward. Inside the collar are two well-marked dorsal cephalic swellings.

A conspicuous ruffled membrane extends inward from the ventral fissure of the collar, inside each branchial lobe, folds on itself, and terminates at the ventral end. On each side of the mouth is a very large, irregular, leaf-like membranous lobe supporting a long, slender, dorsal tentacle, which is attached near its base to the inside of the branchial lobe.

Fascicles of setæ laterally elongated as in *Pseudopotamilla* and *Eudistylia*.

Setæ of the collar fascicle and superior ones of the other thoracic fascicles, with regularly tapered, lanceolate blades; inferior setæ, back of the collar, vary from oblanceolate (the longer) to subspatulate (the shorter) forms; abdominal setæ bent at the base of the long, abruptly tapered blade. Thoracic tori with avicular hooks and pennoned setæ; abdominal tori with avicular hooks only.

This genus forms a connecting link between the genera *Parasabella* and *Potamilla*.

ASPEIRA MODESTA sp. nov.

Pl. xxv, fig. 3; Pl. xxxvi, figs. 27–31, 33–35.

Type locality. — Kadiak.

Color in formalin yellowish, with the branchiæ broadly and irregularly banded with light chestnut.

Number of segments about 90, with 6 on one side of the thorax and 7 on the other; the fascicles of setæ in slightly oblique series.

Branchiæ about 11 mm. in length, arranged in a single series of 13 equal pairs, besides 2 small undeveloped ventral ones.

Length about 46 mm., or 1.6 inches; breadth 5 mm.; length of thorax along setæ about 5 mm.

Kadiak, July 3, one specimen.

Genus **Potamilla** Malmgren 1865.

Type, *Potamilla neglecta* (Sars).

The genus *Potamilla* of Malmgren appears to have been rather vaguely used by subsequent writers. It was proposed in 1865 for the species *Sabella neglecta* Sars (1851), redescribed and figured as the first species, and *Potamilla torelli* Malmgren, which are readily distinguished, especially from species of *Sabella*, by the bilobed collar meeting at the dorsal furrow and by shorter, broader, *subspatulate*, inferior thoracic setæ; their borders, however, being equal, not unequal as given by Malmgren.

It was also suggested that *Sabella reniformis* (Müller) Leuckart might be referable to the same genus, but the excellent figures given in 1867 show a marked difference in the four-lobed collar with deep dorso-lateral incisions or notches, as well as in the shorter, *spatulate* inferior thoracic setæ. The new name *Pseudopotamilla* is therefore proposed for such forms.

All species hitherto referred to *Potamilla* need much careful study before their correct relationship can be determined. *Potamilla malmgreni* Hansen (1882) from N. L. 63–65° +, W. L. 5–7° +, in 1163–1215 fathoms, should be referred to the genus *Potamis* Ehlers (1887).[1] The avicular thoracic hooks are somewhat analogous in form to those in *Euchone*.

Genus **Pseudopotamilla** nov.

Type, *Potamilla reniformis* (Müller + Leuckart) Malmgren.

This generic name is proposed for species similar to *P. reniformis* which have hitherto been referred to the genus *Potamilla*.

The branchial lobes are simple, and not prolonged ventrally, but differ from those in *Potamilla* in having the dorsal ends protected by a stiff, sharp or thin edge, often turning outward. Malmgren's figure 77A, Pl. XIII, 1867, is not sufficiently clear to show this.

The collar is four-lobed, meeting on the back, with small, angular, dorsal lobes formed by conspicuous dorso-lateral incisions or notches, and more or less developed, usually pointed, ventral ends.

[1] Type, *Potamis spathiferus* Ehlers, from off the coast of Florida, in 275 fathoms.

Oral membranes as in *Potamilla* and related genera; one extending inward from each side of the ventral fissure, along the base of each branchial lobe, folding on itself to the ventral end of the lobe; the other, inside this, more or less irregular, leaf-like in form, supporting long, slender, tapered, dorsal ends.

Fascicles of the setæ small, laterally elongated, in straight series; thoracic tori comparatively short, of about uniform length. Inferior thoracic setæ, back of the collar fascicle, spatulate in form.

Müller 1771, as *Amphitrite*, Leuckart 1849, as *Sabella*, Quatrefages 1865 and McIntosh 1868, as *Sabella saxicava*, Malmgren 1867 + Marion and Bobretzky 1875 + Marion 1878 + Langerhans 1884 + Andrews 1891 and Saint-Joseph 1894, as *Potamilla*, have published figures of this species, but as there appears to be considerable variation in the form of the setæ, especially the uncini, it is probable that the name has been sometimes erroneously applied.

In this genus can be placed *Potamilla oculifera* Leidy (1855), which has long been considered synonymous with *P. reniformis*. Figures of the characteristic setæ of specimens (NO. 885 Yale Museum), collected at Watch Hill, Rhode Island, are given on PL. XXXIII, figs. 6, 30; PL. XXXIV, fig. 11; PL. XXXVII, figs. 11, 13, 14, 29. *Potamilla tortuosa* Webster (1878), from the Virginia coast, has similar inferior thoracic setæ, and may possibly belong here. McIntosh (1885) thought this identical with the species from Torquay identified by him as *Sabella saxicava*. *Pseudopotamilla reniformis* (Müller) was recorded from Bering Sea by Marenzeller (1890).

PSEUDOPOTAMILLA DEBILIS sp. nov.

PL. XXXVI, figs. 23, 24, 26.

Type locality. — Pacific Grove, California.

A long, slender, delicate, nearly colorless specimen, has only faint indications of brown along the distal portion of the branchiæ, which number about 16 in each lobe and are very long (about 7.5 mm.) and very slender, with long, delicate, well-separated pinnæ and a few scattered eyes.

The collar has very wide dorso-lateral notches and long, narrow, pointed, ventral ends.

There are 8 thoracic and over 50 abdominal segments (extremity mutilated).

Length of thorax along setæ about 4 mm.; breadth about 2.5 mm.

Genus **Schizobranchia** nov.

Type, *Schizobranchia insignis* sp. nov.

The three most typical species (*insignis*, *nobilis*, and *concinna*) of this genus are remarkable for their large size and beautiful deep wine-colored, much-divided branchiæ.

The small, nearly semicircular branchial lobes are simple, not spiral, and bear long branchiæ, stout at base, often irregularly arranged in two series and usually regularly dichotomously divided from 1 to 6 times, so that the tips number several hundred. The ends of the lobes are stiffened and protected by conspicuous, usually white, cartilaginous edges.

The two much smaller species (*dubia* and *affinis*), however, and the young of these large forms, do not have all the branchiæ forked, but some are simple, thus showing a connecting link with species of typical *Pseudopotamilla*, in which all the branchiæ are simple.

Eyes numerous, varying in size and arrangement along the back of most of the rachises of the branchiæ.

Mouth protected on each side by three deep membranous frills or folds. The two outer ones form a single membrane, which is attached at one end to the inner surface of the ventral edge of the branchial lobe, extends inward along the base of the lobe to about the middle, then, folding on itself, terminates at the collar fastened to the side of the ventral fissure. The inner one, next the mouth, is large, irregular, somewhat leaf-like in form, deepest ventrally and abruptly tapered into a long narrow end; dorsally bearing a delicate filamentose tentacle, which arises from the inner surface of the dorsal edge of the branchial lobe.

Collar four-lobed, as in *Eudistylia* and *Pseudopotamilla;* deepest along the sides beyond the small, angular, dorsal lobes, curving more or less broadly and abruptly forward from the dorso-lateral notches, ending in small angular processes on each side of the shallow ventral fissure.

Body long and usually slender, more or less compressed dorso-ventrally, very gradually tapered to the pointed posterior end. Dorsal groove most conspicuous on the first segments. Fascicles of setæ similar in form to those of *Eudistylia* and *Pseudopotamilla*, usually in a nearly straight series on the sides of the thorax, often oblique in much contracted specimens.

Setæ similar in form to those of *Pseudopotamilla*.

Chitinous tubes usually solitary when fully developed, twisted about one another in colonies or groups when immature; thick along their

lower embedded portions, of a rusty brown color, much thinner above, of a light horn color, sometimes tinged with wine color, covered with a thin layer of fine gray sand, to which small hydroids, ascidians, and seaweeds adhere; within, sometimes beautifully iridescent or silvery.

SCHIZOBRANCHIA INSIGNIS sp. nov.

Pl. XXIV, figs. 1, 2; Pl. XXVII, fig. 1; Pl. XXVIII, fig. 5; Pl. XXXV, figs. 2, 12, 13, 15, 16, 26, 27.

Type locality. — Yakutat.

This large species is light brown in color, more or less tinged with pink, with the branchiæ sometimes of the same tone but usually of a deep wine color.

Segments short, flattened, numbering about 180 in the largest specimens, of which 8 belong to the thorax; in those of medium size the number varies from 6 to 8.

Branchiæ stout at base, comparatively short, the larger portion of them of nearly uniform length, measuring 17 mm. They are often arranged somewhat biserially, and number about 16 in the outer or regular series; in immature specimens the number often differs in the two lobes. Each rachis is usually regularly dichotomously divided from one to four times, so that there may be between 200 and 300 terminal branches (occasionally one occurs which has three primary divisions); the pinnæ are long and slender, crowded distally, forming very blunt, broadly rounded ends, which are often much twisted.

Eyes large, numerous, irregularly placed on the back of most of the rachises, principally along the posterior portion.

Collar very deep at the sides, at the end of the slightly developed dorsal lobes.

Fascicles of setæ in slightly oblique series on the thorax.

Many of the specimens have eggs showing along the abdominal tori.

Length of a perfect specimen about 158 mm., or 6.25 inches; breadth at base of collar about 7 mm.; length of thorax along setæ about 14 mm. A young, much contracted specimen has 18 pairs of branchiæ, all forked, the longest twice. It is about 5 mm. in breadth, and has 8 thoracic and 80 abdominal segments in a length of 37 mm. Another, less contracted one, about 4 mm. broad, has 16 pairs of branchiæ, 8 thoracic and 100 abdominal segments in a length of 75 mm. A smaller one, about 3.5 mm. broad, has 18 pairs of simple branchiæ, 8 thoracic and 50 abdominal segments in a length of about 20 mm.

Victoria, Vancouver Island, British Columbia, June 1, one poorly preserved specimen; New Metlakatla, Annette Island, June 4, three very young specimens; Yakutat, June 19, numerous specimens.

SCHIZOBRANCHIA NOBILIS sp. nov.

Pl. XXIV, fig. 3; Pl. XXVIII, fig. 7; Pl. XXXIII, fig. 22; Pl. XXXV, figs. 1, 3–6, 8, 10, 11, 23.

Type locality. — Orca, Prince William Sound.

This species often has the whole body pervaded with pink or light wine color, and is larger than the preceding (*S. insignis*), with longer (about 23 mm.), more flexible, and more numerous branchiæ, there being about 26 in the outer series in each lobe, but similarly divided, the longest 4 times; the pinnæ are less crowded, forming more tapered ends.

Eyes numerous, varying in size and arrangement, sometimes with a diagonal line of pigment.

Many of the specimens are without posterior portions. The largest has 72 segments in a length of about 165 mm., or 6.5 inches. It is about 8 mm. broad at base of collar, and the 8 thoracic segments measure about 15 mm. along setæ. Two specimens "killed in formalin" are much contracted, and vary in breadth at base of thorax from 10 to 12 mm. The anterior fascicles of setæ form very oblique series, and on one specimen number 9 in a length of 15 mm.; on the other there are 8 in a length of 12.5 mm. Both have lost posterior portions, one having 60 segments in a length of 72 mm., the other 80 segments in 98 mm. In one the branchiæ, which number about 22 in each lobe, are beautifully expanded, the longest measuring about 30 mm. They are stout, unequal at base, and not regularly dichotomously divided, some having 4 and 5 divisions, so that some of the tips are double and some single, and may number 26 on a single branchia. Young specimens common at Dutch Harbor, Unalaska Island, about 3 mm. broad and from 25 to 75 mm. long, have from 6 to 8 thoracic segments, 12 to 16 pairs of branchiæ, the longest divided 2 or 3 times; occasionally one has 3 primary or basal divisions. A single specimen from Virgin Bay, Prince William Sound, differs from these in having 10 thoracic segments; on one side two of them have two fascicles of setæ and two tori. A few specimens contain eggs.

Orca, Prince William Sound, June 25–26, several specimens; Virgin Bay, Prince William Sound, June 27, one immature specimen; Dutch Harbor, Unalaska Island, July 8 and 17, many young.

SCHIZOBRANCHIA CONCINNA sp. nov.

Pl. XXIII, figs. 2, 3; Pl. XXVIII, fig. 2; Pl. XXXIV, figs. 15, 17, 18; Pl. XXXV, figs. 17, 24.

Type locality. — Orca, Prince William Sound.

At Orca, with the preceding species (*S. nobilis*), the anterior portion of a single specimen was found, which is remarkable for its slender rounded form and long, unequal, very slender branchiæ with their numerous terminal branches, about 22 in each lobe, the long ones about 30 mm. in length, often regularly forked 6 times, so that one might have as many as 64 tips. The pinnæ are long and very slender. The eyes are numerous and very conspicuous, though varying in size, often with a diagonal line of pigment.

There are about 16 segments in a length of about 33 mm., 8 of which belong to the thorax, which is about 7.5 mm. in breadth at base of collar and 13 mm. in length along setæ.

Young, varying in size from 11 to over 50 mm. in length and .5 to 3 mm. in breadth, have 5 to 14 pairs of branchiæ, 6 to 8 thoracic and from 40 to over 60 abdominal segments. They differ from *S. dubia* in having both body and branchiæ tinged with delicate pink or wine color and the setæ and avicular uncini larger and more numerous.

SCHIZOBRANCHIA DUBIA sp. nov.

Pl. XXVIII, fig. 1; Pl. XXIX, fig. 1; Pl. XXXIII, fig. 7; Pl. XXXVI, figs. 1, 2, 3, 17, 18, 19, 20; Pl. XXXVII, fig. 28.

Type locality. — Orca, Prince William Sound.

This species bears a superficial resemblance to *Pseudopotamilla reniformis* (Müller) and *P. oculifera* Leidy, but differs in having some of the branchiæ forked.

The slender tubes are found in closely crowded masses.

The animals in preservation show but a slight tinge of brown on the base of the branchiæ, which are relatively long and slender, with long graceful pinnæ forming broadly rounded ends. Eyes very conspicuous.

There is great irregularity in the development of the 40 or 50 specimens examined. Among those of the same size, the larger number have 6 and 7 thoracic segments on opposite sides, a few have 8, and one has 9; in those differing in size this inconstancy is still more marked. The smallest specimen, about 6 mm. long and 1 mm. broad, has 8 thoracic and 25 abdominal segments, 5 pairs of branchiæ, the dorsal ones forked; another, about 7 mm. long, has 8 thoracic and about 50 abdominal segments, 7 pairs of branchiæ; another, 15 mm.

long, has 6 and 7 thoracic and 50 abdominal segments and 8 pairs of branchiæ; among the largest specimens, 67 mm. long and 2.5 mm. broad, one has 7 thoracic and 115 abdominal segments and 14 pairs of branchiæ, and another has 8 thoracic segments and 15 pairs of branchiæ. There is also great diversity in the number of branchiæ which become forked.

The short tori and small fascicles of setæ forming straight series along the sides of the body, and the inferior spatulate setæ usually arranged in two parallel rows, appear to be constant in character.

Numerous specimens of a similar slender form collected at Dutch Harbor, Unalaska Island, differ in their relatively shorter, stouter, more divided branchiæ and in the greater number and size of their setæ and avicular uncini, which agree in form with those of *S. nobilis*.

SCHIZOBRANCHIA AFFINIS sp. nov.

Pl. XXXIII, figs. 9, 11, 17, 23; Pl. XXXV, fig. 9.

Type locality. — Popof Island.

Two small crimson or wine-colored specimens appear to have little affinity with those of similar size belonging to other species. They are immature, as only one has the longest dorsal branchiæ forked; and as they are said to have been dredged, they are probably the young of some shallow-water form.

They are about 3 mm. in breadth, and have from 13 to 16 pairs of branchiæ about 7 mm. in length, which have long, rather stout, regularly developed pinnæ and a few conspicuous eyes. In both specimens posterior segments are wanting. One has 9 thoracic and 35 abdominal segments in a length of 27 mm., and the other has 8 thoracic and 20 abdominal segments, with well-developed eggs showing along their tori, in a length of 28 mm.

Genus **Eudistylia** nov.

Type, *Eudistylia gigantea* sp. nov.

Like *Distylia* of Quatrefages (1865), this genus has the branchial lobes equal and spirally coiled, forming more or less elongated, permanent spires, differing in this character from typical *Sabella* and other genera which have the branchial lobes attached but a portion of their length, the more or less prolonged ventral portion being free and spirally twisted or involute in retraction, flaring in expansion (Pl. XXVI, fig. 2). Dorsal ends protected or stiffened by a conspicuous, usually white, thin edge.

Branchiæ numerous, usually simple, rarely divided, generally arranged in a single series, sometimes irregularly biserial, plumose, with a stout, gradually tapered, three-sided stem or rachis, rounded on the back, without appendages, flattened and slightly grooved along the inner surface, with thin membranous edges along the two angles, especially posteriorly, outside of which the long slender pinnæ arise. These decrease in length, more or less abruptly, near the end, leaving a short tapered tip. Groups of from 2 to 6 long delicate cilia, arranged in alternating longitudinal rows, are found on the surface of the pinnæ, under a high power.

Eyes usually present, irregularly arranged on one or both sides of the back of some of the rachises.

Collar four-lobed, meeting on the back, but little developed dorsally, arching more or less abruptly from dorso-lateral notches and continuing obliquely in a more or less undulating curve to small ventral ends.

A thin, wide, ruffled membrane extends inward from the ventral fissure along the base of the branchial lobes to the summit of each spire. Next the mouth are two large, irregular, leaf-like tentacles.

Body more or less compressed dorso-ventrally, gradually tapered to the pointed posterior end. Dorsal furrow very conspicuous anteriorly.

Fascicles of setæ, forming more or less oblique series on the thorax, of two forms: superior ones crescent-shaped, inferior ones laterally elongated, protected by a conspicuous auriform membrane. On the abdomen they are laterally elliptical.

Superior setæ comparatively few, with narrow lanceolate ends. Inferior setæ more numerous, of two forms, those of the first fascicle at the base of the collar with broader ends, those of the other fascicles, in 6 to 8 parallel rows, with spatulate ends. Setæ on the abdomen somewhat similar to the inferior ones of the collar fascicle, but longer and bent at the base of the blade. Two forms in the thoracic tori — avicular hooks (uncini) and pennoned setæ; avicular hooks only in the abdominal tori.

This genus is readily distinguished from *Distylia* by the *spatulate* inferior thoracic setæ.

EUDISTYLIA GIGANTEA sp. nov.

Pl. XXI, figs. 1, 2; Pl. XXII, figs. 4, *a*, *c*, *d*; Pl. XXIII, fig. 1; Pl. XXV, fig. 4; Pl. XXXII, figs. 1–8, 10–14, 16, 17, 21, 23–26; Pl. XXXIV, fig. 23.

Type locality. — Orca, Prince William Sound.

Color in formalin, yellow, tinged with brown, the branchiæ with three conspicuous bands of dark maroon or wine color. Small speci-

mens are much paler. Number of segments about 340, of which 8 belong to the thoracic region. They are very short on the abdomen, so that the tori are closely crowded. Branchial lobes forming well-separated spires of about 2½ turns, measuring about 16 mm. in height, without branchiæ.

Branchiæ long and flexible, the longest from 33.5 to 36.5 mm. in length in different specimens, numbering 125 to 135 in each lobe, and usually arranged in a single series; occasionally one occurs which has an additional one in front of it; one is also sometimes divided.

Eyes of good size, varying in number on different specimens and also in number and relative position on the same specimen.

Collar increasing abruptly in height from the wide angular lateral notches, slanting obliquely forward at a considerable angle, with slightly undulating margin and ending in two prominent angular processes on either side of the median ventral fissure.

Dorsal furrow very deep on the first few segments, turns to the right at the seventh segment, passes diagonally across the eighth segment to the ventral region, then diagonally across the first abdominal segment, turning downward into the ventral groove at the second segment.

Length of largest specimen 12 inches, breadth at end of thorax about 17 mm.; length of thorax along setæ about 13 mm., varying in different specimens from 11 to 15 mm. Another perfect specimen is 9.75 inches long and about 15 mm. wide.

Tube solitary, more or less bent, of a tough brownish chitinous substance, the rough surface usually covered along the exposed portion with sponges, ascidians, hydroids, seaweeds, etc.

Yakutat, June 22, two small specimens; Orca, Prince William Sound, June 25, ten large specimens; Virgin Bay, Prince William Sound, June 26, two small specimens.

Some of the specimens are abnormally developed. In the one figured, where an injury has been repaired, the symmetry in the arrangement and form of the thoracic setæ is interrupted, on one side between the sixth and seventh segments and on the other between the seventh and eighth. The additional one has no slender lanceolate superior setæ, but a somewhat elliptical fascicle of spatulate setæ, like the inferior ones; no torus, but an elliptical fascicle of setæ similar to those on the abdomen. Another, which also shows repairs of injuries, has 10 thoracic segments and smaller branchial lobes forming spires of about 1½ turns, with but 70 to 80 shorter (about 27 mm.) branchiæ arranged mostly in a double series, sometimes branched, rarely more than once. The avicular hooks also vary somewhat in form.

In some, eggs are seen through the integument along the abdominal tori.

A number of parasitic nematode worms were taken from the entire length of one specimen which was dissected. They were twisted about the spirally coiled intestine, filling the cavity on the sides of the segments.

EUDISTYLIA PLUMOSA sp. nov.

Pl. XXI, figs. 3, 4; Pl. XXII, fig. 4, *b*; Pl. XXXII, figs. 9, 15, 18, 19, 20, 22.

Type locality. — Sitka.

Color in formalin, light brown, the branchiæ banded with delicate pink. The specimen is imperfect, there being but about 60 segments, of which 8 belong to the thoracic region. On the abdomen they are about twice as long as in the other related species, and well rounded.

Branchial lobes forming spires of 3 full turns measuring in height about 13 mm. without the branchiæ, which are beautifully plumose, long (about 22 mm.), very graceful, rarely divided, numbering about 135 in each lobe, arranged in a single series.

Eyes small, few, scattered, being present on but a few of the rachises.

Collar with very small dorsal lobes, increasing abruptly in height from small lateral notches, arching upward and forward in a regular curve to the conspicuous ventral ends.

Dorsal furrow very deep on the first three segments, turns to the right, passes diagonally across the eighth segment to the ventral region, curves around the fascicle of setæ of the first abdominal segment, and merges into the ventral groove on the second.

Length 4.5 inches; breadth at the end of thorax about 12 mm.; length of thorax along setæ about 13.5 mm.

Sitka, one imperfect specimen with a tough, semitransparent, chitinous tube.

This species can be readily identified by its rounded, little-tapered form, long and rounded segments, high collar, and very graceful and plume-like branchiæ.

EUDISTYLIA ABBREVIATA sp. nov.

Pl. XXIV, fig. 4; Pl. XXXIII, figs. 1, 2, 10, 18, 5; Pl. XXXIV, figs. 13, 16.

Type locality. — Yakutat.

Although similar in coloring to *E. gigantea*, this species is easily recognized by the comparatively short, stout branchiæ. Medium-sized specimens (Pl. XXIV, fig. 4) show a striking resemblance in form to species of *Schizobranchia*.

Branchial lobes forming low spires of about 2 turns, with 70 or 80 short (about 16 mm.), stout, stiff, rarely divided branchiæ. Eyes very small and few in number.

Collar deep along the sides, curving abruptly and obliquely from the dorso-lateral notches to the rounded ventral ends.

Thoracic segments 8; abdominal segments in a medium-sized perfect specimen about 240; one very large mutilated one has over 325 segments.

The former is 6.5 inches, or 164 mm. long, 12 mm. along thoracic setæ, and 8.5 mm. broad at base of collar. Large ones are 12 mm. broad, and probably attain a length of 10 or 12 inches. One of the smallest specimens, with about 100 segments, is 30 mm. long and about 2.5 mm. broad.

Tubes covered with rather coarse black and variegated sand, which in turn is sometimes overspread by compound ascidians.

Yakutat, June 22, seven specimens; Ocean Cape, Yakutat, five specimens; Sitka, June 17, one specimen.

EUDISTYLIA TENELLA sp. nov.

Pl. XXII, figs. 2, 3; Pl. XXIII, figs. 4, 5; Pl. XXXIII, figs. 16, 19, 24; Pl. XXXIV, fig. 12; Pl. XXXV, fig. 22.

Type locality. — Victoria, Vancouver Island, British Columbia.

This species is at once distinguished by its very delicate branchiæ, the inner edges of their very slender rachises bordered by opaque yellowish crenulations from which the exceedingly fine cilia-like pinnæ arise.

In the largest specimen the segments are irregularly developed on both the thorax and abdomen, especially along the middle portion, where some are divided on one side and others on the opposite side, the total number, however, being about the same (175); of these 10 on the left side and 11 on the right side belong to the thorax, the irregularity occurring on the first three segments. Three smaller specimens are, however, symmetrically developed and have but 8 thoracic segments.

Branchial lobes forming low spires of about 2 turns, bearing from 70 to 75 very slender branchiæ in an irregular double series, measuring about 16 mm. in length, usually of a very delicate pink color, sometimes with a broad band of deep wine color near their tips. Eyes none.

Collar with inconspicuous dorsal lobes, and wide shallow lateral notches, from which it slants obliquely forward to the small ventral ends.

Length of largest specimen about 4.5 inches; breadth at base of collar 6 5 mm.; length of thorax along setæ 15 mm. A more contracted one is 3.25 inches long, 8 mm. broad in middle of thorax.

Victoria, British Columbia, June 1, four specimens.

EUDISTYLIA POLYMORPHA (Johnson).

Bispira polymorpha JOHNSON, Proc. Boston Soc. Nat. Hist., vol. 29, p. 428, pl. 17, figs. 179–183; pl. 18, figs. 184, 185, 1901.

One young from Pacific Grove, California, and two well-grown specimens from Victoria, Vancouver Island, British Columbia, are readily identified by their conspicuous black eyes (PL. XXIX, fig. 6).

Recorded by Johnson[1] from Pacific Grove, California, to Puget Sound, Washington.

EUDISTYLIA INTERMEDIA sp. nov.

PL. XXXIII, figs. 26, 28; PL. XXXIV, figs. 19, 20, 26; PL. XXXV, figs. 21, 29.

Type locality. — Pacific Grove, California.

Animal in formalin, pale cream color, with a brownish tinge on both the dorsal and ventral surfaces of the thorax, and a spot of dark bluish pigment showing through the integument at the side of each fascicle of setæ; a similar color showing also along the anterior abdominal tori; a broad band of brown and pinkish purple on the lower portion of the branchiæ, and a narrow, scarcely discernible pink one farther out.

Branchial lobes forming spires of about 3 turns, 13 mm. in height, each with 60 or more rather slender branchiæ, the longest about 18 mm. Pinnæ numerous and closely crowded. The thin dorsal ends of the lobes very noticeable. Eyes very small and scattered.

Collar but slightly developed dorsally, narrow on the sides, arching obliquely forward in an undulating curve, ending in small rounded ventral ends.

There are 8 thoracic and about 175 abdominal segments.

Length without branchiæ 144 mm.; breadth of thorax 10 mm.; length along setæ 11 mm.

This species is readily distinguished from *E. polymorpha* (Johnson) by its more numerous branchiæ, inconspicuous eyes, and form of the avicular uncini, which have much shorter, stouter necks, longer beaks, and are larger and less evenly rounded in front.

[1] Johnson's figure 179 on plate 17 is given as the 'ventral aspect'; it should be 'dorsal.' Also in his description on p. 428 'dorsal' should read 'ventral,' and *vice versa*.

CHONE TERES sp. nov.

Pl. xxx, fig. 1; Pl. xxxvii, figs. 16–23.

Type locality. — Dutch Harbor, Unalaska Island.

A very slender species of a uniform yellowish tint, with very short branchiæ and very gradually tapered posterior end without ventral groove or sucker.

In the single specimen preserved in its tube, the segments, about 80, of which 8 belong to the anterior region, are not very clearly defined.

Branchiæ very short, about 12 in each lobe, longer in the right than in the left one, probably due to inequality in contraction, the longer twisted about the shorter, their rachises connected for the greater part of their length by a delicate membrane. They are furnished on their inner surface with numerous very delicate pinnæ, which end abruptly, leaving a thin, comparatively short, broad, abruptly tapered, naked, terminal portion. Eyes none.

Collar very deep, about 2½ times that of the first segment. Above there are several very long delicate filaments, either abnormal pinnæ or undeveloped branchiæ. There are two short, stout, dorsal tentacles.

Both dorsal and ventral grooves or furrows clearly defined; the dorsal one turning abruptly to the right passes between the eighth and ninth (last thoracic and first abdominal) segments diagonally across the latter below, and merges into the ventral one.

Fascicles of setæ in very straight series, as is usual in this genus. Superior fascicle very small, of but a few slender limbate setæ (Pl. xxxvii, fig. 16) placed on the first segment at the base of the collar and on the succeeding segments above the elongated inferior fascicle of two rows of spatulate setæ (fig. 20), which is above and in front, or forward of and somewhat oblique to the short torus having a single row of hooked setæ (fig. 21). There are also found in the superior fascicles a few with abruptly bent shafts — bayonet setæ (fig. 18). On the abdomen the setæ are slender, limbate (fig. 17), in an elongated fascicle just in front of and below the very short torus of uncial plates (figs. 22, 23).

Length about 56 mm.; branchiæ about 8 mm.; anterior or thoracic region 9 mm.; breadth 2.5 mm.

Tube rough, thin, flexible, semitransparent, amber color, more or less tinted with brown, with very little adhering sand.

Although no mention of figures of odd 'bayonet' setæ have been noticed in descriptions of any of the known species of this genus, they are not regarded of sufficient importance to warrant any change in the

generic name, especially as they may be easily broken or not mounted in such a way as to show, and are consequently overlooked.

Chone duneri Malmgren (1867), from Spitzbergen, is a slender species, but is only half as long as the present one, with fewer, very long branchiæ having long, slender, naked terminal portions. *Chone infundibuliformis* Kröyer (1856), specimens of which from Greenland are before me, is a short stout species, with conspicuously marked segments and grooves, with very long branchiæ which number about 22 in each lobe.

Genus **Metachone** nov.

Type, *Metachone mollis* sp. nov.

The setæ on the thorax of *M. mollis* are similar to those of *Dialychone acustica* Claparède (1870) from Naples, the type of the genus *Dialychone*, but the abdominal uncini are more nearly like those found in species of *Euchone;* while in *D. acustica* they more nearly resemble those of *Sabellides* Malmgren 1865 (Ampharetea), with the lowest tooth larger than the others.

METACHONE MOLLIS sp. nov.

pl. xxxv, figs. 19, 20, 28.

Type locality. — Pacific Grove, California.

A slender colorless specimen has lost a posterior portion, so that its exact generic position is uncertain. The setæ are similar to those of *Megachone aurantiaca* Johnson (1901), but there are additional inferior clavate ones on the thorax, which were not found in that species.

In the one branchial lobe preserved there are 17 branchiæ, with slender tapered tips and long delicate pinnæ, connected for the greater part of their length by a delicate web.

Collar deep, with dorsal incision only, *i. e.*, open on the back, with ends in contact.

Length of 8 thoracic and 10 abdominal segments 27 mm., breadth 2.5 mm.; length of branchiæ about 8 mm.; length of thorax about 10 mm.

The species described and figured by Verrill (1885) as *Sabella picta* is a *Metachone.*

Marenzeller (1890) recorded *Euchone analis* (Kröyer) Malmgren from Bering Sea. It is possible that on further examination this may prove to be a distinct species, more nearly related to *M. mollis.*

Family ERIOGRAPHIDIDÆ.

MYXICOLA CONJUNCTA sp. nov.

Pl. XXVI, figs. 1, 4, *a*; Pl. XXXVIII, figs. 1–11.

Type locality. — Virgin Bay, Prince William Sound.

In general appearance this species closely resembles the *Myxicola steenstrupi* Kröyer from the Bay of Fundy.

Like that species its body is a pale yellow color, but the pinnæ of the branchiæ are of a decided brown, which shows through the pale rachises and web, giving a tinge of color to the whole. There is also sometimes a tinge of brown on the thorax.

The body gradually tapers, both forward and backward, from the end of the thorax, and differs considerably in length in full-grown specimens. The segments, which are well marked, biannular, vary in number from 100 to 115, of which 8 belong to the thorax.

As the branchiæ arise directly from the edge of the first segment, there are no smooth basal portions or lobes visible. There are 20 on each side, which are moderately long and tapered, their rachises connected by a membranous web for the greater part of their length, leaving comparatively long, slender, unadorned free ends; pinnæ numerous, very long and slender. Eyes none.

There is no collar, but the edge of the first segment is drawn inward on each side on a line with the fascicle of setæ, and below it is produced forward into a thin median triangular lobe, to protect the ventral branchial opening. A conspicuous membrane arises on each side of the dorsal groove or furrow, passes inward between the dorsal division of the branchiæ and around the mouth, forming two loops; there are no tentacles.

The dorsal furrow is conspicuous the entire length of the thorax, turns to the right, passes diagonally across the eighth and ninth (first abdominal) segments, and merges into the but faintly indicated ventral furrow.

The fascicles of setæ form straight series along the sides of the body, and are at first round and cushion-like in form, but decrease in size and become laterally compressed and somewhat elliptical in form on the succeeding segments.

On the first segment the setæ are of one form, long, with short, rather broad blades terminating in long slender capillary ends, and are arranged like needles around the edge of a cushion. The setæ of the next four segments are similar to these. On the sixth to eighth segments additional, often more slender, spear-shaped or hastate setæ

occur in the middle of the fascicle, which also have long slender capillary tips; these apparently become worn off, as the simple spear is often seen, and they often have more color than the other setæ. The hooked setæ are difficult to find, probably because easily broken, but have been seen on all but the first segment, never more than two together.

On the abdomen the setæ are spear-shaped, with long terminal filamentous ends. The uncial plates have a long slender primary tooth and a shorter closely appressed secondary one. They form a nearly complete circle around the body, passing posterior to the fascicles of setæ, interrupted only by a narrow ventral area.

Length of one of the largest specimens 120 mm.; breadth at base of thorax 7 mm., at first segment 5 mm.; length of branchiæ about 17 mm. A much more contracted specimen of 85 segments is about 55 mm. in length, 9 mm. in breadth at base of thorax, and 4.5 mm. at first segment, with the branchiæ 14 mm. in length. The smallest specimen, of about 50 segments and 10 pairs of branchiæ, is 15 mm. long, besides 7 mm., the length of the branchiæ.

Virgin Bay, Prince William Sound, June 27, sixteen specimens embedded in thick jelly.

MYXICOLA AFFINIS sp. nov.

Pl. XXXVIII, figs. 17–20.

Type locality. — Pacific Grove, California.

A specimen filled with eggs, of a decided yellow color, with a greenish tinge to the branchiæ, especially the very long pinnæ, has 8 thoracic and 50 abdominal segments and 20 pairs of branchiæ with comparatively long, free, slender tapered tips.

It is very like specimens of *Myxicola steenstrupi* Kröyer (see Pl. XXXVIII, figs. 13–16, 21, 22, 24) from the Bay of Fundy, but has the limbate setæ much broader, and the hooked thoracic setæ (numbering 14 on the last segment) stouter and much less curved.

Length 4.5 mm.; greatest breadth of thorax 5.5 mm., of first segment 4.5 mm.; length of branchiæ 12 mm., of free end 3 mm.

Myxicola pacifica Johnson (1901) is a larger species, with 9 thoracic segments and 14 pairs of very long (21 mm.) branchiæ.

MYXICOLA GLACIALIS sp. nov.

Pl. XXII, fig. 1; Pl. XXV, figs. 1, 2; Pl. XXVI, fig. 4, *b*; Pl. XXXVIII, figs. 12, 23, 25–32.

Type locality. — Dutch Harbor, Unalaska Island.

This is a slender species, with the body of the usual cream color, the thoracic region and branchiæ colored with deep purple having a tinge

of brown. In life " white or yellowish with brown purple branchiæ."

Like all the species, there are the longer and shorter forms, but all taper gradually backward from the first segment, and have long, well-marked, biannular segments, which vary in number from 70 to 100, of which but 3 belong to the thorax.

There are 14 pairs of branchiæ, each with a rather short and broad terminal portion reaching beyond the web; the long, well-separated pinnæ are sometimes much curled and twisted.

The triangular ventral lobe of the first segment is well developed; the lateral puckerings are not always noticeable, and the distinction between the thoracic and abdominal regions is not clearly defined by a groove or furrow.

The hooked setæ, 4 in number, were found on the second and third segments and the uncial plates on the fourth (first abdominal) segment, and form a complete circle around the body commencing at about the twelfth segment, passing posterior to the fascicle of setæ.

The largest specimen is about 80 mm. long and 3.5 mm. broad at the first segment; branchiæ about 13 mm. long. The smallest specimen, of about 50 segments, with 9 pairs of branchiæ, is about 17 mm. long and 2.5 mm. broad, with the branchiæ 5 mm. long.

Dutch Harbor, Unalaska Island, July 8 and 17, thirty specimens embedded in much mucus under and between stones on shelly sand.

Tribe SERPULIDES.

Family SERPULIDÆ.

Comparatively few authors have attempted any systematic work on this difficult group. Philippi in 1844 gave results of his study of the Mediterranean forms; Mörch in 1863 reviewed all the then known species and gave fine figures of the operculum of many of them; Levinsen in 1883 added to the northern forms, but, as in the case of the Sabellides, Saint-Joseph in 1894 gave an extensive analytical table of the known genera, proposing many new ones, based on the different forms and arrangement of the setæ.

In studying many species, however, one soon finds it impossible to adopt all of his changes, especially in the genus *Spirorbis* (see p. 252), and that, although so many new names appear, there are still many interesting and peculiar forms which require to be separated under new genera; no attempt, however, has been made to find the correct generic relation of all the species hitherto published.

As similarly stated under the Sabellides, the following analytical table for the genera which are related to the genus *Serpula* is based

primarily on characters readily seen with the aid of a good pocket lens.

In instances, however, where the operculum has been lost other characters become most important, so that owing to the very small size of many of the animals higher powers are required.

Many forms which have simple tapered setæ in the collar fascicle are found to possess uncini and abdominal setæ which differ decidedly in form, so that many of the genera are based on these two characters. This is especially true of species hitherto referred to the genus *Vermilia* Lamarck 1818. As no figures appear to have been published of the setæ and uncini of the type species (*Vermilia triquetra* Lamarck), the only known character by which the genus is distinguished is the operculum with a calcareous plate, which was figured by Philippi in 1844. Langerhans in 1880, however, described and figured a species identified as *Vermilia polytrema* Philippi, which has not only the calcareous plate on the operculum but also two basal horny or chitinous spine-like processes, not unlike the figure given by Philippi 1844. The uncini have rather numerous long sharp teeth, the lowest much larger than the others and notched in the end, giving a bifid appearance; the abdominal setæ are trumpet-shaped, with a long slender end. The *Vermilia nigropileata* Ehlers 1901 has similar uncini, but the operculum is described as having a black horn-colored end without calcareous deposit. The *Spirobranchus occidentalis* McIntosh has a similar black horny cap on the operculum and similar uncini. Several species from Bermuda with a similar operculum are often found with the horny end covered by a thin layer of calcareous deposit which can be readily cleaned off. It is not improbable that the same condition existed in Lamarck's and Philippi's species and has been overlooked. "Operculum *testaceum* orbiculatum, simplex," was interpreted by Philippi as 'calcareus operculum.' The Bermuda species, however, as well as those described and figured by Marenzeller 1893 and Moore 1904 have uncini and abdominal setæ very unlike those given by Langerhans, McIntosh, and Ehlers, and also differ from each other. *Vermilia multivaricosa* (Mörch 1863) Marenzeller 1893, having the abdominal setæ strongly geniculate with, broad angular tapered blades, was made the type of the genus *Vermiliopsis* by Saint-Joseph 1894. The figures of *Vermilia infundibulum* Claparède 1870 and those of *Vermilia spirorbis* Langerhans 1883 do not appear to agree very closely with this species, although Marenzeller made them synonymous. *Vermilia multicristata* (Philippi 1844) Marenzeller 1893, having but slightly bent, narrower, regularly tapered abdominal setæ, as well as different uncini, is here referred to the new genus *Metavermilia*, as

type; and one of the Bermuda species (*P. bermudensis* sp. nov.) having nearly straight regularly tapered setæ similar to those on the thorax, with deeply serrate edges and still different uncini, is made the type of another new genus, *Paravermilia*. The thoracic setæ in all three forms are regularly tapered, differing only in their comparative length and breadth; the opercula are also alike in having a horny or chitinous end which varies greatly in form. In the Bermuda species it forms a high, irregularly bent or curved tapered cone made up of several unequal parts which fit on to each other, resembling a spiral shell.

The uncial plates in the numerous forms belonging to this family show great variability in form, are often very irregular in outline, but the opposite sides stand in definite relation to each other so that 'tetragonal,' 'rectangular,' 'rhomboid' and 'trapeziform' have been adopted for them in the following table.

ANALYTICAL TABLE FOR SERPULA AND RELATED GENERA.

1. With an operculum.... ..... 2.

1′. Without an operculum (see p. 226)**..... ..... 14.**

2. One or more entire branchiæ differentiated into or replaced by a peduncle bearing an operculum.. .... 3.

2′. Tip only of one or more branchiæ differentiated into an operculum-like organ (see p. 226)**..... 11.**

3. Operculum furnished with a calcareous plate..... 4.

3′. Operculum furnished with a chitinous or horny plate (see p. 223)**..... 8.**

4. Collar setæ present..... ..... 5.

4′. Collar setæ absent.

(1) PLACOSTEGUS Philippi 1844.

Type, *P. tridentatus* (Fabricius 1779, as *Serpula*, + Gunnerus 1768, figure, as *Serpula triquetra*, + Philippi 1844, figure, as *P. crystallina*) Mörch 1863, as first species, also as *P. tricuspidatus*, + Levinsen 1883, figures, + Marenzeller 1893, figures. North Atlantic Ocean, in 20–200 fms.

Uncial plates rectangular in form, with very numerous fine appressed teeth, the lowest large and fang-like. Operculum with calcareous plate.

(2) PLACOSTEGOPSIS Saint-Joseph 1894.

Type, *P. langerhansi* (Marenzeller 1893, as *Placostegus*, + Langerhans 1883, figures, as *Placostegus tricuspidatus*, *non* Sowerby) Saint-Joseph 1894. Madeira, Atlantic Ocean.

Uncini similar to those in *Spirorbis*. Operculum with a simple calcareous plate.

5. Superior setæ not simple tapered blades..... 6.

5′. Superior setæ simple tapered blades.

(3) DASYNEMA Saint-Joseph 1894.

Type, *D. chrysogyrus* (Grube 1878, figures, as *Serpula*) Saint-Joseph 1894. Philippine Islands, Pacific Ocean.

Uncini somewhat similar to those in *Spirorbis* (?), "pectiniform with numerous teeth." No figure. Operculum with shallow calcareous cap.

(4) VERMILIA Lamarck 1818, + Philippi 1844, restricted.

Type, *V. triquetra* Lamarck 1818 (*non Serpula triquetra* Linné), + Philippi 1844, figure, + Mörch 1863, as *V. dinema*. Mediterranean Sea.

Uncial plates not known. Operculum with elongated, somewhat cylindrical calcareous cap, figured as not covering the entire end of the operculum, thus giving the appearance of basal processes.

(5) POMATOCEROS Philippi 1844.

Type, *P. triquetra* (Linné 1767, as *Serpula*, + Leuckart 1849, as *P. tricuspis*, *non* Philippi 1844, figure) Mörch 1863, as first species, + Saint-Joseph 1894, figures.[1] North Sea, Atlantic Ocean.

Uncial plates trapeziform, with pointed teeth, the lowest one larger than the others. Operculum with calcareous plate bearing a cluster of yellowish spines (usually three). See PL. XLIV, fig. 3.

(6) GALEOLARIA Lamarck 1818.

Type, *G. cæspitosa* Lamarck 1818, + Mörch 1863, as first species. Australia, Pacific Ocean.

Uncini unknown. Operculum with tessellated calcareous cup bearing variable movable spines.

6. Superior setæ variable in form.

(7) SPIRORBIS Daudin 1800 (see p. 236).

Type, *S. spirorbis* (Linné 1760, + Daudin 1800, as *S. borealis*) (see p. 262). North Sea on *Fucus*, Atlantic Ocean.

Uncial plates somewhat rectangular, with rather numerous appressed equal teeth. Operculum with the calcareous plate variable in form.

6′. Superior setæ constant or uniform..... ..... 7.

7. Superior setæ with posterior fin-like expansion.

(8) FILOGRANULA Langerhans 1883.

Type, *F. gracilis* Langerhans 1883, figures. Madeira, Atlantic Ocean.

Uncial plates similar to those in *Spirorbis*. Operculum with calcareous concave cap.

7′. Superior setæ geniculate, with numerous small spines at base of blade.

(9) POMATOSTEGUS Schmarda 1861.

Type, *P. stellata* (Abildgaard 1789, figures, as *Terebella*) Schmarda 1861, as *P. macrosoma*, figures, + Mörch 1863, + Baird 1865, + Benedict 1886, figures. West Indies, Atlantic Ocean.

Uncial plates tetragonal, with numerous pointed teeth, the lowest one larger, blunt and more conspicuous than the others. Operculum consisting of a number of separate calcareo-chitinous or horny plates joined by a central axis in the form of a pyramid.

(10) SPIROBRANCHUS Blainville 1817. (*Cymospira* Savigny 1809, + Blainville 1828.)

Type, *S. giganteus* (Pallas 1766, figures, as *Serpula*, + Blainville 1828, figures, as *Cymospira*), Mörch 1863, figures, + Ehlers 1887, figures. West Indies, Atlantic Ocean.

[1] In the series of specimens from Denmark, in the Yale Museum, some of the opercula have apparently lost the spines, which are replaced by a conspicuous node of calcareous deposit. The collar setæ are small and few in number.

Uncial plates tetragonal, with somewhat irregular, pointed teeth, the lowest one larger than the others, often blunt, twisted. Operculum with a calcareous plate bearing a cluster of branching spines.

8. Collar setæ present ..... 9.

8′. Collar setæ absent.

(11) RHODOPSIS gen. nov. (see p. 179 and Addendum).

Type, *R. pusillus* sp. nov. Bermuda, Atlantic Ocean.

Uncial plates tetragonal, with appressed teeth, the lowest larger than the others. Operculum with a chitinous or horny disk covered with horny spines in the form of a rosette.

9. Superior setæ on collar not simple tapered blades ..... 10.

9′. Superior setæ on collar simple tapered blades.

(12) VERMILIOPSIS Saint-Joseph 1894.[1]

Type, *V. multivaricosa* (Mörch 1863, as *Vermilia*, + Marenzeller 1893, as *Vermilia*, figures) Saint-Joseph 1894, restricted. Mediterranean Sea.

Uncial plates tetragonal, with appressed rather blunt teeth, the lowest larger and more conspicuous than the others. Operculum with horny cap.

(13) PARAVERMILIA gen. nov. (see p. 221).

Type, *P. bermudensis* sp. nov. Bermuda, Atlantic Ocean.

Uncial plates somewhat rectangular, with appressed teeth, the lowest large and blunt. Operculum with horny cap often resembling a little spiral shell.

(14) METAVERMILIA gen. nov. (see p. 220).

Type, *M. multicristata* (Philippi 1844, figure, as *Vermilia*, + Langerhans 1883, as *Vermilia multicostata* and *Vermilia clavigera*, figures, + Marenzeller 1893, as *Vermilia*, figures). Mediterranean Sea.

Uncial plates trapeziform, with long slender teeth, the lowest longer than the others. Operculum with a conic horny cap.

(15) HYALOPOMATUS Marenzeller 1878.

Type, *H. claparedii* Marenzeller 1878, figures. Arctic Ocean, off Nova Zembla, in about 125 fms.

Uncial plates tetragonal, with numerous appressed teeth, the lowest very long and fang-like. Opercula membranous? bulb with central air-chamber. (The figure shows distinct cell structure.)

(16) DITRYPA Berkeley 1832–4.[2]

Type, *D. arietina* (Müller 1776) Berkeley 1832–4, + M. Sars 1835, figures, + Saint-Joseph, 1898. Shore of Norway, Atlantic Ocean.

Uncial plates somewhat similar to *Spirobranchus*. Operculum with flat horny plate ornamented with striæ.

(17) JANITA Saint-Joseph 1894.

Type, *J. fimbriata* (Della Chiaji 1828, as *Serpula*, figures, + Philippi 1844, as *Placostegus*,[3] figure, + Mörch 1863, + Langerhans 1883, as

[1] *Vermilia agglutinata* Marenzeller 1893, figures, is a *Vermiliopsis*.

[2] Berkeley's species was *D. subulata* (figures) and Sars' species, *D. libera*.

[3] Philippi described the operculum as having a calcareous plate, which is figured as a simple disc, not at all like Langerhans' figure. Future study may prove the two forms to be distinct species.

Omphalopoma spinosa, figures, + Marenzeller 1893, as *Omphalopoma*, figures) Saint-Joseph 1894. Mediterranean Sea.

Uncial plates rhomboidal, with appressed teeth, the lowest long and blunt. Operculum with concave horny cap.

10. Superior setæ with posterior fin-like expansion.

(18) OMPHALOPOMA Mörch 1863.[1]

Type, *O. umbilicata* Mörch 1863. Philippine Islands, Pacific Ocean.

Uncini unknown. Operculum with a concave horny cap.

(19) HYALOPOMATOPSIS Saint-Joseph 1894.

Type, *H. marenzelleri* (Langerhans 1883, figures, as *Hyalopomatus*) Saint-Joseph 1894. Madeira, Atlantic Ocean.

Uncini somewhat similar to *Spirorbis*, the teeth longer. Operculum with a chitinous or horny cap.

(20) CHITINOPOMA Levinsen 1883.[2]

Type, *C. greenlandica* (Malmgren 1867, as *Hydroides*) Levinsen 1883, figures, as *C. fabricii*. Greenland, North Atlantic Ocean.

Uncial plates trapeziform, with appressed teeth, the lowest larger than the others. Operculum with concave horny plate.

(21) OMPHALOPOMOPSIS Saint-Joseph 1894.

Type, *O. langerhansi* (Marenzeller 1884, as *Omphalopoma*, figures) Saint-Joseph 1894. Japan, Pacific Ocean.

Uncial plates trapeziform, with comparatively few pointed teeth, the lowest large and blunt. Operculum with concave horny plate.

10′. Superior setæ geniculate, with conspicuous spines at base of blade.

(22) SERPULA Linné 1767, + Philippi 1844.

Type, *S. vermicularis* (Ellis 1755, figures, as *Tubus*) Linné 1767, + Saint-Joseph 1894, figures. North Atlantic Ocean.

Uncial plates tetragonal, with few unequal coarse serrations. Primary operculum funnel-shaped, with numerous radii forming serrations on margin; secondary operculum usually club-shaped, occasionally like primary one.

(23) SCLEROSTYLA Mörch 1863.

Type, *S. ctenactis* Mörch 1863. St. Thomas, West Indies, Atlantic Ocean.

Uncini like *Serpula*. Operculum with comparatively few radii forming a scalloped margin; intermediate between *Serpula* and *Crucigera*. It is described by Mörch as calcareous.

(24) ZOPYRUS Kinberg 1866.

Type, *Z. loveni* Kinberg 1866,[3] as first species. Straits of Magellan, Island of Bucket, Pacific Ocean.

Uncial plates unknown. Opercula funnel-shaped and club-shaped.

[1] Saint-Joseph (1894) restricted this genus to *O. cristata* Langerhans (1883), figures, from Madeira, which has a thin concave horny plate in the operculum and uncini somewhat similar to those in *Spirorbis*.

[2] *Vermilia serrula* Stimpson 1853, + Verrill 1885, figure, from Grand Manan, New Brunswick, appears to be synonymous with this species.

[3] As no figures of this species seem to have been published, very little definite knowledge is available by which to determine the correct position of the genus; Ehlers 1901 placed it next to *Serpula*.

(25) CRUCIGERA Benedict 1886.

Type, *C. websteri* Benedict 1886, figures. Gulf of Mexico, Atlantic Ocean, in 26 fms.

Uncial plates similar to those in *Serpula*. Operculum with cup similar to that in *Sclerostyla*, but with conspicuous basal processes.

(26) HYDROIDES Gunnerus 1768.

Type, *H. norvegica* Gunnerus 1768, figures, + Mörch 1863, figures, + Marenzeller 1893, figures, + Saint-Joseph 1898. North Atlantic Ocean.

Uncini similar to those in *Serpula*. Operculum similar in form to *Serpula*, with a central crown of horn-colored spines, each with lateral processes.

(27) EUPOMATUS Philippi 1844.[1]

Type, *E. uncinatus* Philippi 1844, figure, + Quatrefages 1865, figures, + Ehlers 1887, figures. Mediterranean Sea.

Uncini similar to those in *Serpula*, with fewer teeth than type. Operculum similar in form to *Serpula*, with a central crown of horn-colored, simple, curved, regularly tapered spines without lateral processes.

(28) EUCARPHUS Mörch 1863.[2]

Type, *E. cumingii* Mörch 1863, figures. Philippine Islands, Pacific Ocean.

Uncini similar to those in *Serpula*. Operculum[3] similar to that of *Serpula*, with central crown of horn-colored spines the ends of which are blunt, with a lateral process on each side.

(29) SCHIZOCRASPEDON gen. nov. (see p. 287).

Type, *S. furcifera* (Grube 1878, as *Hydroides*, figures). Philippine Islands, Pacific Ocean.

Uncini somewhat similar to those in *Eupomatus*. Operculum forming two deep funnels, one above the other, without radii, with the edge of each split into long, slender, divided processes; those on the upper one with small, dark spines on their inner proximal portion.

(30) GLOSSOPSIS gen. nov. (see p. 287).

Type, *G. minax* (Grube 1878, as *Hydroides*, figures). Philippine Islands, Pacific Ocean.

Uncini similar to the preceding. Operculum a deep funnel without radii, the edge cut into broad deep points, each with a terminal knob; a long, rounded, tongue-like, curved process with fluke-like tip, bearing a

[1] *Polyphragma* Quatrefages 1865 included *Eupomatus* and *Hydroides*.

[2] *Phragmatopoma* Mörch 1863, type *P. caudata* (Kröyer) Mörch 1863, figures, has an operculum resembling that of *Sabellaria virgini* Kinberg 1866, + Ehlers 1901, figures (Hermellidæ), and is probably closely related to that genus. Kinberg (1866) refers three new species to the genus, which he places in his family Hermellea.

[3] The *Eupomatus lunulifera* Claparède 1870, figures, has a similar operculum and should be referred to *Eucarphus*.

lateral palmate form of about 7 long unequal pointed lobes, arises from the center of the cup.

11. Operculum with a calcareous plate (see p. 221).

Superior setæ on collar simple tapered blades.

(31) JOSEPHELLA Caullery and Mesnil 1896.

Type, *J. marenzelleri* Caullery and Mesnil 1896, figures. Cape de la Hogue, northern coast of France, English Channel.

Uncini similar to *Vermiliopsis*. Operculum with long conic calcareous plate.

11′. Operculum membranous or chitinous ..... 12.

12. Superior setæ on collar not simple tapered blades ..... 13.

12′. Superior setæ on collar simple tapered blades.

(32) APOMATUS Philippi 1844.

Type, *A. ampulliferus* Philippi 1844, + Marion and Bobretzki 1875, figures.[1] Mediterranean Sea.

Uncini similar to *Protula*. Operculum a membranous(?) sphere.

(33) APOMATOPSIS Saint-Joseph 1894.

Type, *A. similis* (Marion and Bobretzki 1875, as *Apomatus*, figures, + Marion 1879, figures) Saint-Joseph 1894. Mediterranean Sea (Marseilles).

Uncini and operculum similar to preceding.

13. Superior setæ geniculate.

(34) PROTOPLACOSTEGUS gen. nov. (see p. 287).

Type, *P. mörchii* (McIntosh 1885, as *Placostegus*, figures).

Uncini somewhat similar to *Serpula*. Operculum with horny cap.

13′. Superior setæ with posterior fin-like expansion.

(35) FILOGRANA Oken 1815, + Berkeley 1832.[2]

Type, *F. implexa* Berkeley 1827, as *Serpula*, figures, + Saint-Joseph 1894, figures. (See footnote 2.) North Atlantic Ocean, in 20 to 40 fms.

Uncini similar to *Vermiliopsis*. A spoon-shaped organ on one or more branchiæ.

14. Superior setæ on collar not simple tapered blades, *i. e.*, with posterior fin-like expansion (see p. 221).

(36) SALMACINA Claparède 1870.[2]

Type, *S. incrustans* Claparède 1870, figures. Bay of Naples, Mediterranean Sea.

Uncini somewhat similar to *Serpula*.

[1] Saint-Joseph proposed to separate the four species (*A. ampulliferus* Philippi 1844, *A. enosimæ* Marenzeller 1885, *A. globifera* Theel 1879, and *A. similis* Marion and Bobretzki 1875) into two genera based on the difference in form of the abdominal setæ, under the names *Apomatus* and *Apomatopsis*, but unfortunately places the species for which the genus *Apomatus* was proposed, under the later name, thus, unless transposed, making the two synonymous.

[2] *Salmacina ædificatrix* Claparède 1870 (appendix) is figured as having the tips of the branchiæ regularly tapered. The spoon-shaped end figured by Saint-Joseph (1894) as belonging to *Salmacina dystera* Huxley (as *Protula*, 1855) is either an error in reference for *Filograna implexa*, or the species is erroneously referred to *Salmacina*.

(37) PROTIS Ehlers 1887.

Type, *P. simplex* Ehlers 1887, figures. West Indies, Atlantic Ocean, in 860 fms.

Uncini similar to *Eupomatus*.

14′. **Superior setæ on collar simple tapered blades**..... 15.

15. **Branchial lobes not spiral.**

(38) PSYGMOBRANCHUS Philippi 1844.[1]

Type, *P. protensus* (Gmelin) Claparède 1870, figures. Mediterranean Sea.

Uncini similar to *Protula*.

15′. **Branchial lobes spiral.**

(39) PIRATESA Templeton 1835.[2]

Type, *P. nigroannulata* Templeton 1835, figures, + Kinberg, 1866. Black River, Island of Mauritius, Indian Ocean.

Uncini unknown.

(40) PROTULA Risso 1826.

Type *P. rudolphi* Risso 1826, as first species. Mediterranean Sea at Nice in about 3 feet.

Uncial plates irregular in outline, with numerous very fine teeth on the face, the lowest one very long and fang-like.

(41) PROTULOPSIS Saint-Joseph 1894.[3]

Type, *P. intestinum* (Lamarck 1818, as *Protula*) Saint-Joseph 1894, figure. Seas of Europe (Triest and Naples).

Uncini unknown.

[1] *Psygmobranchus cæcus* Claparède 1870 has uncini with few coarse teeth like *Eupomatus*, and is probably referable to *Protis*, although Claparède suggested its resemblance to *Salmacina*. *Psygmobranchus multicostatus* Claparède 1870 has uncini more nearly like *Serpula*, so that it should be referred to *Salmacina*.

[2] *Anisomelus luteus* Templeton 1835, from the figures, shows characters placing it with the Terebellacea as designated by Quatrefages (1865), rather than with the Serpulacea as given by Mörch (1863). There are four pairs of branchiæ, very long and very short, below which, on the thorax, are 6 filaments similar to those found on *Trichobranchus glacialis* Malmgren 1865, figures.

[3] Saint-Joseph (1894) makes *Protula intestinum* Lamarck, an abdominal seta of which he figures, the type of a new subgenus, *Protulopsis*. There is, however, considerable uncertainty in regard to the other characters, as no figures have been found. Excellent figures are given by Fischli (1900) of his species *Protulopsis nigra-nucha*; the uncini are similar to *Hyalopomatopsis*.

PROTULA ATYPHA sp. nov.

Pl. XXXVII, figs. 1, 2, 4.

Type locality. — Pacific Grove, California.

An imperfect animal without color, poorly preserved in a portion of a white, calcareous, irregularly bent tube.

There are but 12 segments back of the thorax, which is long, of 7 segments, all of the well-separated fascicles of setæ directed obliquely backward in nearly straight series, the wide membrane bordering it forming a rather deep irregular (mutilated) collar.

Branchial lobes of good size, elongated ventrally and involute, bearing numerous (about 30, besides a few rudimentary ventral ones) long, delicate (?), densely pinnate branchiæ in each lobe.

No operculum.

Mouth parts not determinable.

Setæ on the thorax of one form, slender, unequal (the shorter ones the broader), capillary, those on the collar fascicles not different from the others. Setæ on the abdomen in small fascicles and bent at the base of the moderately broad tapered blade (Pl. XXXVII, fig. 1).

Both thoracic and abdominal tori small, with the thin uncial plates (Pl. XXXVII, figs. 2, 4) of similar size and form, apparently smooth, with only a long pointed terminal tooth, serrations but faintly visible on the exposed surface even under a high objective.

Length of thorax 9 mm.; breadth about 3 mm.; length of longest branchia about 9 mm.

Pacific Grove, California, August, 1901, one specimen.

The thoracic membrane does not form a scalloped border along the sides, so conspicuous in *P. media* Stimpson from Grand Menan, New Brunswick, figured by Smith and Harger 1874 (see Pl. XLIV, fig. 7), and the setæ are much coarser, those of the latter being very slender; the (much narrower) uncial plates also have more distinct teeth.

On account of its long abdominal setæ, Saint-Joseph would doubtless refer this species to his new subgenus *Protulopsis*, in which the abdominal setæ are "oblique bayonets, plicate on the border," as in *P. intestinum* Lam. *Protula* as a subgenus is restricted for species having shorter 'sickle-shaped' abdominal setæ, as *P. tubularia* Montagu. The figures given by Benedict (1886) of the abdominal setæ of *P. diomedeæ* and *P. alba* show little resemblance to the figure given by Saint-Joseph of that of *P. tubularia*, but all three and others are mentioned by him as belonging together.

The very small *Protula arctica* Hansen 1882 was referred to the genus *Protis* by Ehlers 1887 (type, *Protis simplex*). The uncial plates have but a few (6) coarse teeth, and the collar setæ have a distinct basal expansion or fin. There is no operculum.

HYALOPOMATOPSIS OCCIDENTALIS sp. nov.

Pl. XL, figs. 3, 22; Pl. XLIV, figs. 2, 4, 8, 9.

Type locality. — Virgin Bay, Prince William Sound.

Small, thick, white, calcareous, angular, more or less curved tubes, with a prominent median keel, were attached to tubes of *Serpula splendens*. They strongly resemble the figure of the tube of *Chitinopoma greenlandica* (Mörch)[1] given by Levinsen in 1883 as *C. fabricii* (*Serpula triquetra* Fabricius *non* Linné).

The colorless animal also has a long, slender, rounded form similar to Levinsen's figure.

The branchial lobes are small, not prolonged ventrally, nor involute, and bear 6 pairs of long branchiæ, their rachises broad at base and furnished on their inner surfaces with long, graduated, ciliated pinnæ not extending to the end but leaving a long, unadorned, terminal portion; an additional smaller undeveloped branchia is on the end of the lobe opposite the one bearing the operculum. This is a small, elongated, semitransparent bulb on a very long, slender peduncle, often covered on the end with delicate algæ (Pl. XLIV, fig. 8), in the adult specimens usually showing an inner sphere (air bubble?).

No thoracic membrane.

Collar very deep, with deep lateral clefts.

There are about 60 segments, of which 7 belong to the thorax, where the fascicles of setæ form straight series and the tori are short.

[1] Mörch in 1863 referred the *Serpula triquetra* of Fabricius 1780 to *Hydroides norvegica* as var. *grönlandica*, which Malmgren in 1867 separated as a distinct species, referred to *Hydroides* with doubt, so that Levinsen's name *fabricii* is superfluous.

Specimens attached to stones from Greenland and to the tubes of *Nothria conchylega* from 32 fathoms off the New England coast are in the Yale University Museum, and may prove to be the same as those on the same host from Greenland identified by Moore (1902) as *Serpula* sp.; these could not be compared. The operculum (Pl. XXXVII, figs. 3, 9) is covered by a thin chitinous cup-like plate, and has not the bulb-like form of the western species. When stained and mounted in glycerine, a central chamber with connecting peduncle-canal was distinctly revealed, which differs from that in the opercula of *Spirorbis* in having three distinct parts, those above and below the central chamber or cavity being filled with animal matter. See also Pl. XL, fig. 31.

Setæ of the collar fascicle of two forms, long slender limbate and others with broad spinous basal fin (Pl. XL, fig 22). Other fascicles with shorter and broader limbate setæ. No capillary ones, as in *Spirorbis*.

Uncini with numerous teeth, the lowest one larger than the others.

Abdominal setæ small, trumpet-shaped, with a long tapered end.

Total length of largest specimens between 15 and 20 mm.; breadth about .5 mm. Smallest specimen about 5 mm.

Virgin Bay, Prince William Sound, June 27, eight specimens.

SERPULA SPLENDENS sp. nov.

Pl. XXVI, fig. 3; Pl. XXIX, fig. 2; Pl. XXX, figs. 2, 3; Pl. XXXIII, fig. 31; Pl. XXXV, fig. 18; Pl. XXXVII, fig. 31; Pl. XXXIX, fig. 33.

Type locality.—Prince William Sound, at Orca and Virgin Bay.

Color in formalin yellowish, with the branchiæ and operculum variously banded and mottled with deep crimson, which in life is a 'brilliant red.'

Thoracic membrane with a very wide margin overlapping on the back and forming a very deep rolling collar with a median ventral and two lateral incisions.

Branchial lobes with comparatively small basal attachment, arching obliquely forward, curving inward ventrally, thickest below and strengthened by a conspicuous tapered median rib, and in front, at the end, by a large rib reaching backward inside the collar. Between these end ribs and attached to them is a broad, gradually widening, muscular band curving inward between the bases of the lobes, forming a trumpet-shaped process over the mouth; above this is a thin, somewhat ruffled membrane, which extends out on each side around and inside the lobes, attached to their bases; extending forward and inward from the dorsal furrow is a tongue-shaped process, free at the end, having a granular surface, which completely covers the end of the trumpet.

Branchiæ short, between 45 and 50 pairs, their tapered rachises rounded outwardly, with short filamentose tips, the two inner edges bearing long well-separated pinnæ; a few of the extreme ventral branchiæ extend around the end of the lobe and backward or inward along its edge.

Opercula two; the primary one thin, large, deep funnel-shaped, with numerous delicate branching radii, forming a finely serrate (between 127 and 150 serrations) margin, the inner surface often with minute scattered tubercles; base globular, without processes, attached

by a stout peduncle to the dorsal end of either branchial lobe; secondary one, when present, somewhat club-shaped, attached to the opposite lobe by a more slender, shorter stem.

Number of segments about 320, of which 7 belong to the thorax, on which the fascicles of setæ form very oblique series; abdominal segments short, the lines of uncini closely crowded.

Fascicles of setæ on the thorax tubular in form; the first well forward on the collar, smaller than the succeeding ones, and directed forward; the others, directed obliquely backward, vary slightly in size, become flattened and laterally elongated. The setæ are of two forms; on the collar slender capillary superior ones and stout bayonet-shaped inferior ones, spinous at the base of the blade (Pl. XXXIII, fig. 31), on the other segments capillary only; uncial plates with 6 to 7 long teeth, apparently in two rows (Pl. XXXVII, fig. 31). On the abdomen fascicles of the characteristic short flaring-ended setæ, and on the caudal region other small fascicles of very long, slender, stiff spines; uncial plates similar to but smaller than those on the thorax, becoming thicker, with more rows of teeth in the caudal tori (Pl. XXXIX, fig. 33).

In very young animals taken from their tubes, stained, and mounted, the operculum appears club-shaped; the rudimentary branchiæ resemble flattened strips of membrane with long unequal filamentose ends, and are covered by the collar; no membrane appears along the sides of the thorax; this, however, may be due to the position in mounting. There are about 50 rows of uncini on the abdomen, and 7 fascicles of setæ on the thorax; the setæ themselves are similar to those in the adult.

A perfect animal taken from its tube is 53 mm. long besides the branchiæ, which are about 8 mm., 7 mm. broad on the thorax, and 5.5 mm. on the abdomen. A larger imperfect one is 8.5 mm. broad on the thorax and 7 mm. on the abdomen. Diameter of operculum 5 to 7 mm. Another specimen, having about 190 segments, 30 pairs of branchiæ, and one operculum, is about 35 mm. long and 5 mm. broad on the abdomen.

Their tubes are thick, white, calcareous, variously twisted, more or less free, the surface of attachment flattened, the exposed surface often roughened by the small tubes of their own young, and also by species of *Spirorbis* and *Hyalopomatopsis*.

Prince William Sound, at Orca, June 25 and 26, two specimens; at Virgin Bay, June 27, ten specimens.

Serpula jukesii Grube 1877 (*non* Baird 1865) closely resembles this species.

The *Serpula columbiana* abundant in Puget Sound and extending southward along the California coast to Golden Gate is described by Johnson (1901) as having more numerous branchiæ (54 in each lobe), fewer serrations (100) on the margin of the operculum, and but 250 abdominal segments in a length of 55 mm., with a breadth of 7 mm. on the thorax.

Specimens collected by Dr. Coe in August, 1901, on the California coast are supposed to be immature examples of this species. They are without color in formalin, except one, which has two pink spots at the base of the trumpet-shaped process, but when first received one showed both red and orange bands on the branchiæ. The larger has 20 pairs of well-developed branchiæ, besides a few small ventral ones having very short pinnæ, and the operculum has 110 serrations on its margin. An example of the Alaska species of similar size has 35 pairs of branchiæ and 127 serrations on the margin of the operculum.

Genus **Crucigera** Benedict 1886.

Type, *Crucigera websteri* Benedict.[1]

The very small type species of this genus, a cotype specimen of which, from 26 fathoms in the Gulf of Mexico, has been sent from Washington, has four 'digital processes' at the base of the operculum, the axis of which is continuous with that of its peduncle. The Alaskan species, however, have but 3, 2 of them combining, forming a large, rounded, bilobed process, to which the abruptly contracted distal end of the peduncle is so attached that its axis is not continuous with that of the operculum. Benedict describes the texture as 'calcareo-cartilaginous,' but the operculum of the northern species, after soaking in potash solution, retains its form as a thin, transparent, chitinous shell. The tube is ornamented on one side by three conspicuous lamellar-like longitudinal carinæ, and on the opposite side by faintly indicated ridges. The thicker tubes of the northern forms show no indication of such ornamentation.

The operculum of *Serpula zelandica* Baird (1865), as shown in the figure, has similar coarse, blunt serrations on the margin, but no processes at its base, thus representing a transition between typical *Serpula* and *Crucigera*, and therefore referable to *Sclerostyla* Mörch 1863.

[1] Proc. U. S. Nat. Mus., IX, p. 550, pl. XXI, figs. 24, 25; pl. XXII, figs. 26–30, 1886.

CRUCIGERA ZYGOPHORA (Johnson).

Pl. xxix, fig. 5; Pl. xxxi, fig. 2; Pl. xxxiii, fig. 3; Pl. xxxix, figs. 8, 12, 13, 15, 17, 20.

Serpula zygophora Johnson, Proc. Boston Soc. Nat. Hist., vol. 29, p. 433, pl. 19, figs. 205, 208, 1901.

Type locality. — Puget Sound.

Color, salmon or yellow, with the branchiæ irregularly banded with deep crimson, the operculum variously mottled with the same color, sometimes flecked on its outer surface with minute white specks.

The branchial lobes are characteristic of the Serpulas, each with about 30 branchiæ, having long, slender, tapered rachises, with very long (over 6 mm.) filamentose ends and moderately long delicate pinnæ.

Thoracic membrane with a wide free margin extending forward as an exceedingly deep collar, the ventral lobes of which often roll backward, nearly or quite covering the thorax.

Segments numerous, 115 or more; 6 on the thorax below the collar; those on the abdomen often marked only by the lines of uncini.

Often two opercula; the primary one bell-shaped, thick, shallow, sometimes so thick as to become flat on top, with 28 to 30 radii forming a bluntly scalloped margin; at its base are 3 conspicuous unequal processes, attached by a long peduncle to the base of one of the branchial lobes at its outer dorsal end; the secondary one, which is more or less club-shaped, without basal processes is, when present, attached by a shorter peduncle to the opposite lobe.

Length 50 to 80 mm.; breadth about 3 mm.; branchiæ about 15 mm.; diameter of operculum 4 mm.

One imperfect specimen is recorded by Johnson from Puget Sound, 1901; Sitka, June 15, common; Orca and Virgin Bay, Prince William Sound, June 25 and 27, very common.

Tube thick, calcareous, attached to fragments of shells in variously twisted masses, the free anterior end with a flaring margin.

CRUCIGERA FORMOSA sp. nov.

Pl. xxviii, figs. 3, 4; Pl. xxxi, fig. 1; Pl. xxxiii, fig. 4; Pl. xxxix, figs. 6, 7, 10, 11, 14.

Type locality. — Dutch Harbor, Unalaska Island.

This species differs from the preceding in having shorter branchiæ, their rachises with short terminal filaments, sometimes wanting; yellowish in preservative but a 'brilliant red' in life.

The operculum has the basal processes nearly equal, smaller and somewhat tapered, and the distal end of the peduncle but slightly contracted. A delicate alga, a species of *Ectocarpus*, completely covers the anterior end. There is no secondary operculum on the type; a specimen from Wrangel, however, has two fully developed ones, to only one of which the *Ectocarpus* has become attached.

Length about 60 mm.; branchiæ about 6 mm.; breadth of abdomen 3 mm.; of thorax 4 mm.; diameter of operculum 3 mm.

Tube thick, calcareous, but slightly twisted.

Wrangel, June 5, one specimen; Dutch Harbor, July 8, one specimen. Said to be very common.

CRUCIGERA IRREGULARIS sp. nov.

Pl. XXV, fig. 5; Pl. XXIX, fig. 4; Pl. XXXIII, fig. 13; Pl. XXXIX, figs. 1–5.

Type locality. — Juneau.

Color pinkish, the branchiæ and operculum banded and mottled with bright crimson.

This species differs from the two preceding ones in having longer branchiæ, their rachises with comparatively short terminal filaments; but especially in its operculum, which is irregular in form, laterally elongated, with about 32 broad radii, which form a thick scalloped edge, which rolls over along the longer and deeper portion. Only one large, broadly rounded, somewhat bilobed process is developed at one side of the base, to which the abruptly contracted distal end of the long stout peduncle is attached; secondary operculum very slender, club-shaped.

Length about 48 mm. from base of branchial lobes; breadth of thorax 4 mm.; longer diameter of operculum 4.5 mm.

Tube thick, calcareous, solitary, attached to a shell.

Juneau, July 6, one specimen.

EUPOMATUS GRACILIS sp. nov.

Pl. XXVII, fig. 9; Pl. XXXIV, fig. 25; Pl. XXXVII, figs. 26, 27.

Type locality. — Pacific Grove, California.

Branchial lobes similar to those of *Serpula*, but not so prolonged ventrally, turning inward but little, the branchiæ (18 in each lobe) not extending backward along the end of the lobe, as in *Serpula*.

Operculum deep funnel-shaped, tapering regularly into its peduncle without basal enlargement or processes, with comparatively few regular radii forming deep sharp serrations (about 35) on the margin, and

bearing on its upper surface a central crown of 10 or 11 long, tapered, upward-curving, simple, horn-colored spines characteristic of *Eupomatus uncinatus* Philippi (1844) figured by Ehlers 1887; secondary operculum small, club-shaped, on a very short stem. One specimen has only a central horn-colored ring, the crown of spines having been lost, and the margin has apparently been injured on one side, where the serrations have grown together, forming an angulation.

Thoracic segments 7; abdominal segments over 70 in the largest example, which has lost a posterior portion.

A very wide membrane borders the thorax, forming a very deep collar with lateral incisions or clefts but with no median one, the ventral edge being entire; there is, however, a conspicuous oval opening considerably within the margin.

Setæ similar to those in *Serpula*.

Length of thorax 3.5 mm.; breadth 3 mm.; length of longest branchia 5.5 mm.; diameter of operculum 2.5 mm.

Pacific Grove, California, August, 1901, three specimens.

The tubes are solitary, variously twisted, and attached for the greater part of, if not their entire length. The surface, roughened by growth lines, is often rust colored, covered with bryozoa and other animals.

Hydroides protulicola Benedict (1886), specimens of which are in the Yale Museum, is a typical *Eupomatus*, as is undoubtedly *H. spongicola* Benedict, judging from the figures. *Serpula dianthus* Verrill (1874) is also an *Eupomatus*. In *Hydroides* (type, *H. norvegica* Gunnerus) the spines forming the crown on the operculum have conspicuous lateral processes or secondary spines.

EUPOMATUS HUMILIS sp. nov.

pl. xxxix, figs. 39, 40; pl. xliv, fig. 22.

Type locality. — Guaymas, Mexico.

A small (probably immature), thin, very slender, round tube, forming one long irregular loop, is attached its entire length to the side of a small coral.

The five branchiæ are long, stout, with few pinnæ, the very small characteristic operculum on its very slender peduncle reaching above them. The operculum is colorless, with coarsely serrate margin, formed by about 10 long, broad points, crown of 8 long, simple, characteristic spines, each with a basal spinule on its inner surface.

Number of segments unknown, only the anterior portion having been found. Collar setæ few in number, the superior ones with 4

basal spines and slender, delicately serrate blade; setæ in the other fascicles slender blades. Uncini very small, with few sharp teeth.

SPIROBRANCHUS INCRASSATUS (Kröyer) Mörch.

Pl. XXXIV, fig. 24; Pl. XXXVII, figs. 25, 34.

Spirobranchus incrassatus MÖRCH, Rev. crit. Serpulidarum, Natur. Tidss., I, p. 405, pl. XI, figs. 21–23, 1863. — EHLERS, Blake Annelids, p. 294, taf. 57, f. 16; taf. 58, f. 1–5, 1887.

Type locality. — West coast of United States of Colombia.

A valve of *Margaritifera* sp., from the Gulf of California, in the Yale Museum is covered with a mass of the tubes of this species. They are of good size, variously twisted over one another, white, often with markings of light yellowish brown and purplish, the high median or dorsal carina often so roughened by the conspicuous growth lines as to be rendered irregularly spinulose. Many of the largest tubes spread along the base, forming a distinct carination on each side, along and above which the surface is often punctured by the erosion of the surface between the irregular growth lines.

The anterior portion of the animal, with the operculum, was found dried in some of the tubes. The plate on the operculum agrees perfectly with Mörch's figure. Figures of the setæ and uncial plate of a specimen from Acapulco, west coast of Central America, were given by Ehlers (1887).

The single example (999) from Vera Cruz, identified and figured by Benedict (1886) as *S. incrassatus* (Kröyer) Mörch, is not this species, and therefore should receive the new name *Spirobranchus pseudoincrassatus*. The thoracic uncini are described as having from 18 to 20 teeth.

Mörch also described and figured two related forms from the Pacific Ocean, near Puntarenas (Costa Rica, Gulf of Dulce), which do not appear to have been subsequently noted: *Hydroides* (*Eucarphus*) *crucigera* Mörch, on *Margaritifera barbata* Reeve, from 14 fathoms, and *Pomatostegus kröyeri* Mörch.

Genus **Spirorbis** Daudin 1800.

Type, *Spirorbis spirorbis* (Linné 1760) = *Spirorbis borealis* Daudin 1800. (See Pl. XXXIX, fig. 34; Pl. XL, figs. 5, 6, 8, 12–15; Pl. XLII, figs. 15–19.)

Important generic characters for the animal are as follows: — Operculum protected by a calcareous plate, variable in form. Thoracic segments usually 3, rarely 3½ or 4 (Levinsen 1883 + Caul-

lery and Mesnil 1897). Superior thoracic setæ usually differing in form, those of the first or collar fascicle varying from those having simple tapered blades to others having a conspicuous, fin-like basal expansion.

Uncini with rather numerous equal minute teeth in 2 or 3 (?) rows. See also p. 252.

SPIRORBIS SEMIDENTATUS sp. nov.

Pl. XXVII, figs. 7, 10; Pl. XLI, figs. 13, 17, 23, 26–30; Pl. XLIII, figs. 4, 5, 12.

Type locality. — Dutch Harbor, Unalaska Island.

Tube thick and massive, vitreous, rarely showing any transparency, opaque with dull surface, dextral, the few whorls not regularly rounded nor spreading, but piled one above the other, forming a high spire with nearly perpendicular sides and flattened top, without central depression, often with a distinct angular shoulder. Aperture very lustrous within, with a small round opening, the thick shell forming a broad, straight, flattened, inner or columellar margin with a conspicuous projection at its junction with the thinner straight, rounded top edge, from which it arches forward and spreads out in a shining, somewhat iridescent layer on the body of the shell; in some specimens a spiral ridge appears to arise from the outer margin, and is at first ill-defined, but increasing abruptly forms a conspicuous keel, which ends at the aperture in an angular projection; in such instances an added prominence is given to the columellar projection, giving to the aperture a two-toothed appearance. The unkeeled form strongly resembles *S. vitreus* Fabr., but forms a much higher spire and has never been seen so glassy and transparent as specimens of the latter from the Atlantic; immature examples are semitransparent. The carinated form is similar to *S. violaceus*, but is not so regularly coiled nor so deeply grooved. Others are like some forms of *S. variabilis*, but coil in the opposite direction.

Diameter 3 to 4 mm.; height the same.

Animal with 3 thoracic and about 30 posterior segments. Thoracic membrane very conspicuous, partially covering the 7 branchiæ and operculum, which expands from the stout peduncle into a cup-shaped organ the size of the rounded aperture, protected by a moderately thick, saucer-shaped, calcareous plate with an irregularly thickened inner basal ridge; it seems to be covered by a very thin membrane, to which minute protozoans are often attached; the edge of the operculum appears as a dark brown rim.

The thoracic setæ vary in the three segments. All the inferior ones are of the usual slender capillary form; the superior ones of the collar fascicle have a conspicuous, fin-like, posterior expansion and long, narrower, gradually tapered, coarsely serrate, terminal portion; those of the other fascicles have a broad, smooth, tapered blade, a few in the third fascicle with odd comb-like ends. Uncini rather broad, with two rows of minute teeth.

Posterior segments much swollen, bearing conspicuous bunches of mucous glands nearly concealing the two setæ, both of which at first have broad pennant-like blades, but farther back one has the shaft simply pointed and curved.

Strings of undeveloped eggs were in many of the tubes.

Common at Dutch Harbor, on rocks and stones; rare in Prince William Sound, at Orca, on tubes of *Serpula splendens*; and also at Sitka, on shells and tubes of *Crucigera zygophora*.

SPIRORBIS VARIABILIS sp. nov.

Pl. XXIX, fig. 3, *a*; Pl. XXXIX, figs. 24, 25; Pl. XL, fig. 4; Pl. XLIII, fig. 16; Pl. XLIV, fig. 17.

Type locality. — Sitka Harbor.

Tube thick, vitreous, usually semitransparent, sinistral, the few whorls spreading over one another, usually forming a low spire with or without a small central cavity, the top spirally grooved, the grooves in some instances indicated only by the fine sinuous striæ of growth and a slightly raised interspace, in others very deep, with three broad, rounded ridges forming conspicuous notches and tooth-like projections in the margin of the aperture, the margin in the other form being uninterrupted. There is great variation in the manner of coiling, some specimens assuming a form that can be distinguished from *semidentatus* only by its smaller size and opposite coil; others resemble *violaceus* but turn in the opposite direction.

Diameter 2–2.5 mm.; height 1–1.5 mm.

Animal not differing essentially in number of segments, branchiæ, and form of operculum from *S. semidentatus*. Some opercula have two saucer-shaped calcareous plates, which can be readily separated.

Strings of eggs were found along the back of the posterior segments.

Attached to rocks and fragments of shells, either singly or in small colonies.

SPIRORBIS EXIMIUS sp. nov.

PL. XXXIX, fig. 9; PL. XLI, figs. 7, 18, 20; PL. XLIII, figs. 6, 11, 17.

Type locality. — Pacific Grove, California.

Although but a single specimen, which was destroyed in getting at the animal, was found attached to a *Serpula* tube, it is noted on account of its very distinctive operculum plate.

Tube tapered, with a conspicuously corrugated surface, forming a small coil, whether dextral or sinistral was not ascertained.

Animal with 3 thoracic and about 18 posterior segments; eggs showing a distinct nucleus were in the posterior part of the body-cavity. Collar membrane very conspicuous; number of branchiæ not accurately determined.

Calcareous plate on the operculum unusually large, elongated, with large basal lobe having a distinct hook-like projection on one side, similar to that found on the operculum plate of *S. cornuarietis*, as figured by Marion and Bobretzky in 1875 (PL. 12, f. 27, *B*).

Superior setæ of the first fascicle with conspicuously serrate edge and spiny posterior fin-like expansion; those of the other fascicles narrow smooth-edged blades, three odd ones with comb-like ends in the third fascicle. Posterior brush-like setæ very small.

SPIRORBIS MARIONI Caullery and Mesnil 1897.

PL. XXXIX, figs. 26, 27; PL. XL, fig. 16.

Type locality. — Panama.

Small, opaque, more or less regularly coiled, dextral tubes attached to specimens of *Callopoma* from La Paz, Lower California, and Panama, also to valves of *Barbatia* from Acajutla and Libertad, Central America, and to a conglomerate mass of worm tubes, coral, bryozoa, etc., from Guaymas, Mexico, resemble the larger sinistral *S. quadrangularis* Stimpson, in being four-sided. The upper surface has a deep median groove and two conspicuous ridges or carinæ, one defining an inner shoulder around the small, deep, central cavity, and the other an outer shoulder, the entire surface often roughened by growth lines.

The calcareous plate on the operculum differs from fig. 6 given by Caullery and Mesnil, only in the smaller central protuberance, a feature which is undoubtedly variable.

The collar setæ have coarsely crenulate blades and fin-like bases; the other setæ are long, regularly tapered blades, with a few odd-ended ones in the third fascicle.

SPIRORBIS LANGERHANSI Caullery and Mesnil 1897.

Type locality. — Panama.

Scattered over the surface of specimens of *Crucibulum imbricatum* Sby. and *Callopoma* from Panama, are numerous isolated tubes having a regularly coiled sinistral form spreading at the base, often forming a thin border around it. Four-sided in section, with the outer wall oblique and not perpendicular to the inner one, each shoulder of the comparatively narrow, flattened, dorsal area defined by a carina varying in size in different individuals; occasionally one occurs which is not regularly spiral, forming a small central cavity. The entire surface is often roughened by conspicuous transverse lines. No animals were found. Caullery and Mesnil give the collar setæ as similar to those in *S. marioni* and the plate on the operculum not unlike that found in *S. vitreus* Fabricius.

SPIRORBIS MÖRCHI Levinsen 1883.

Pl. XXXVII, figs. 15, 24; Pl. XLI, figs. 15, 16, 21, 24, 25; Pl. XLIV, figs. 20, 21.

Type locality. — Greenland.

Sinistral, dull, opaque unsculptured tubes, forming low coils, with small central cavity, sometimes with upward turned aperture, are not readily identified without their animals, as they are usually more symmetrical than the form figured by Levinsen. They do not, however, differ essentially from eastern specimens on stones from the Grand Banks of Newfoundland and on *Chlamys islandicus* from Greenland.

The collar setæ have a form similar to that given by Levinsen; a long, tapered, coarsely serrate blade with conspicuous, fin-like basal portion. Setæ in the second and third fascicles, long, tapered, delicately serrate blades, a few in the third with odd comb-like ends. Uncini with comparatively coarse teeth.

Operculum not unlike that found in the eastern examples, in which it is a brood-pouch protected by a very convex, bilobed, opaque calcareous cap with a long shield-shaped posterior or inner portion, shallow at the back and extending nearly the length of the operculum in front; the eggs visible only in a back view.

Sitka, on tubes of *Crucigera;* Prince William Sound, at Orca, on the tubes of *Serpula;* also on a specimen of *Pachypoma* from Queen Charlotte Island, British Columbia, collected by the Geological Survey of Canada.

SPIRORBIS INCONGRUUS sp. nov.

Pl. XL, figs. 19, 20, 28.

Type locality. — Prince William Sound.

Associated with the preceding, *S. mörchi*, are smaller, similarly coiled, but dextral tubes, slightly flattened on top, the surface roughened by growth lines, and an ill-defined spiral line feebly indicating an outer shoulder.

Collar setæ also similar to those in *S. mörchi*.

Calcareous plate in the operculum solid and somewhat resembling a plug, thus differing from that of any other species.

Diameter about 1.5 mm.; height about 1 mm.

S. rugatus found on stones at Sitka forms similar dextral tubes, but the collar setæ are finely serrate, tapered blades without any indication of a fin-like base.

Prince William Sound, at Orca, on *Serpula* tubes, and at Virgin Bay, on *Crucigera* tubes.

SPIRORBIS QUADRANGULARIS Stimpson 1853.

Pl. XXXIX, fig. 37; Pl. XL, figs. 10, 11, 21, 23, 26, 30; Pl. XLII, figs. 23–29; Pl. XLIII, figs. 14, 15.

Type locality. — Bay of Fundy, in 10 fathoms.

Tubes found on *Crucigera* tubes from Alaska are not four-sided, but have only a perpendicular inner wall with angular, seldom carinated, shoulder defining a small central cavity. A similar form is very common along the eastern coast, where there is found great variability in the development of the tubes. Young are often without the slightest indication of any angularity, resembling *S. spirorbis* and maturing into the form figured by Levinsen as *S. affinis*, which often twists irregularly upward like *S. lucidus;* others develop a small ridge on top of the whorls, which sometimes increases into a conspicuous carina forming three-sided whorls. Upon examination of specimens this is found to be the form called *S. granulatus* by Moore (1902) and is probably the one identified by Levinsen (1883) as the *S. carinatus* of Montagu (1803). Until the animal of specimens from England can be studied this question must remain undecided, especially as there are in the Yale Museum, on a worn bivalve from England, several sinistral, unicarinate, regularly coiled tubes, which differ from the west Atlantic form in having a large central cavity showing all the whorls, and may prove to be the true *S. carinatus*.

All the animals examined agree in having a similar convex calcareous cap on the operculum and the same form of setæ, those of the col-

lar being long, finely serrate, tapered blades with coarser fin-like bases.

Prince William Sound, at Orca, on *Crucigera* tubes.

SPIRORBIS LINEATUS sp. nov.

Pl. XXXIX, fig. 29.

Type locality. — Sitka.

Moderately thick yellowish tubes, roughened by growth lines, and 2, rarely 3, spiral threads varying in size and position in different individuals, form more or less regular sinistral coils with small central cavity. Sometimes a thread defines the central cavity, and at other times this apparently disappears and one defines an outer shoulder, the median one being constant, the three rarely occurring together. Associated with these are tubes on which the spiral lines are so feeble as to be scarcely discernible. Immature tubes with 3 spiral lines were at first taken to be worn examples of the small *S. granulatus* Linné, on which the three spirals form conspicuous thin lamellæ.

Diameter 1.5 to 2 mm.; height about 1 mm.

The collar setæ of both species are similar in form, being long, tapered, finely serrate blades with spiny fin-like bases.

Sitka, on a much-worn bivalve; and Prince William Sound, at Orca, on *Crucigera* tubes.

SPIRORBIS SIMILIS sp. nov.

Pl. XXIX, fig. 3, *c*; Pl. XXXIX, figs. 16, 31; Pl. XL, figs. 9, 17, 18; Pl. XLIII, figs. 27, 31.

Type locality. — Prince William Sound.

Dull, opaque, unsculptured, usually regularly coiled, somewhat flaring, sinistral tubes with small central cavity, similar to those of *S. mörchi*.

On examination of the animal, however, the operculum plate and setæ were found to be very different in form, the collar setæ being regularly tapered, finely serrate blades, with fine fin-like bases, similar to those seen in *S. lineatus*, and the operculum, a brood-pouch filled with eggs, protected by a flat calcareous plate with a small spreading base and the usual ventral prolongation or supporting wall.

Prince William Sound, at Virgin Bay and Orca, on *Crucigera* tubes; Sitka, on fragments of rock.

SPIRORBIS VIOLACEUS Levinsen 1883.

Pl. XLI, figs. 1, 2; Pl. XLII, figs. 8–12.

Type locality. — Greenland.

Vitreous, strongly grooved and carinated, regularly coiled, dextral tubes agree with eastern specimens from Greenland and the Grand Banks and also with Levinsen's figure.

The plate on the operculum is similar to that figured by Caullery and Mesnil (1897).

The collar setæ are like one form figured by them, but none appears to have any indication of the notch-like irregularity in the edge shown in the other form; the serrations are much coarser than in the figure given by Levinsen.

Sitka, on shells; Prince William Sound, at Orca, on *Crucigera* tubes; also Queen Charlotte Island, British Columbia, on a specimen of *Pachypoma* collected by the Geological Survey of Canada.

SPIRORBIS SPIRILLUM Linné 1760.

Pl. XXVII, fig. 8; Pl. XXXIII, fig. 15; Pl. XXXIX, figs. 21, 22, 23, 28; Pl. XL, fig. 7; Pl. XLII, figs. 1–5; Pl. XLIII, figs. 9, 10.

Type locality. — ? Ocean, on *Sertularia* and other zoophytes.

The dextral discoid form at the present time considered to be the true *S. spirillum* of Linné is very common on algæ from Cape Fox, Alaska, south to Santa Barbara, California. On the eastern coast it is very common on kelp (*Laminaria*) and on the interior of the aperture of univalves (*Buccinum*, *Sipho*, etc.) along the New England coast from Cape Cod to Greenland. The slender ascending form, the true *S. lucidus* of Montagu, also occurs on bryozoans (*Bugula murrayana* and other branching forms) from St. Paul Island, Bering Sea, along the coast of Alaska, south to Pacific Grove, California, where it is also attached to small univalves. On the eastern coast it occurs on bryozoans, hydroids, annelid tubes, and algæ; often attaining a large size, the var. *greenlandicus* of Mörch (*S. porrecta* of Fabricius).

The animals examined from all localities agree in having on the operculum a similar thin, shallow, calcareous plate, with slight inner or basal projection and similarly formed setæ; those of the collar geniculate — abruptly tapered serrate blades, broad and angular at base. There is considerable variation in their length and in the size of the serrations, the latter sometimes being scarcely visible, especially on those of the discoid form from Alaska.

SPIRORBIS RUGATUS sp. nov.

Pl. XXIX, fig. 3, *b*; Pl. XXXV, fig. 14; Pl. XLIV, figs. 18, 19.

Type locality. — Sitka.

On the same fragments of rock with *S. variabilis* were a few specimens, attached singly and in a small colony, of a small dextral species

forming a regularly coiled low spire with central cavity, fragile in texture in preservation, dull opaque, roughened by conspicuous growth and occasional obscure spiral lines. As noted on page 241, they cannot readily be separated from the tubes of *S. incongruus*. Although the specimens are imperfect, their animals more or less mutilated, the following important characters could be ascertained:

Branchiæ 7.

Operculum forming a somewhat cylindrical (imperfect) brood-pouch of simple cell tissue, protected on the end by a thin calcareous cap, but showing no indication of an internal (partition) wall found in this organ in some of the eastern species. One was filled with partially developed eggs; the others had the pouch torn away, leaving the basal expansion in one instance showing the formation of a new calcareous terminal plate (Pl. xxxv, fig. 14) and in another a simple covering of tissue.

Large eggs, showing a nucleus and nucleolus when stained, were in the posterior part of the body-cavity, and smaller ones were scattered through the (10?) posterior segments.

In the 3 thoracic segments the setæ vary remarkably in form. In the collar fascicle the superior ones have very broad, conspicuously scalloped, tapered blades; in the other fascicles they are so narrow as to be scarcely distinguishable from the inferior capillary ones.

SPIRORBIS COMPTUS sp. nov.

Type locality.—? California.

On a red alga from California, without definite locality, associated with *S. spirillum*, is a small, dextral, yellowish species, usually forming a low regular coil with small central cavity, often spreading around the base in a thin layer, the surface roughened by conspicuous transverse lines and three prominent spiral ridges, one defining the central cavity, one median, and one around the outer shoulder; in immature examples the median one is usually the most prominent, the others being scarcely noticeable.

Diameter 1.5 mm.; height less than 1 mm.

The animals were all much dried. In a small specimen the operculum had a thin disk-like plate with an elongated, angular basal portion. In an adult the operculum, filled with eggs, was protected by a flat calcareous cap with long basal shield.

The setæ were similar to those found in *S. rugatus;* those of the collar fascicle, simple tapered blades with serrate edges.

These tubes are much smaller and more fragile than some on shells from Pacific Grove, California, identified as *S. asperatus*.

SPIRORBIS ASPERATUS sp. nov.

Pl. XXVIII, fig. 10; Pl. XXX, fig. 4; Pl. XLI, figs. 4, 5, 6, 8, 10, 11, 19, 31, 32; Pl. XLIII, figs. 1, 2, 3, 7, 13, 26.

Type locality. — Sitka.

Tubes large, rounded, turning upward in a left-handed spiral, the turns resting one above the other or stretched out, forming variously twisted, crowded masses attached to rocks, shells, and worm tubes; opaque, yellowish, without lustre, roughened by conspicuous growth lines and sometimes with one to three more or less definite spiral threads.

Animal long and slender, with 3 thoracic and 16 to 21 posterior segments. Thoracic membrane conspicuous, nearly covering the branchiæ.

Operculum gradually enlarging from the short, stout peduncle, flattened dorso-ventrally and protected on the end by a large, thin, cup-shaped calcareous plate having a large, thin, spreading basal portion.

Superior setæ not differing essentially in form in the three segments; long, narrow, tapered, finely serrate blades; in the third fascicle a few with conspicuously fringed ends were found; as they were not seen in all of the animals examined, it could not be satisfactorily determined whether they simply failed to show in the mounting or actually do not constantly occur.

Strings of undeveloped eggs in some instances were found along the back of the posterior segments, which were much swollen, each with conspicuous bunches of mucous glands partly concealing the two setæ, one of which has the characteristic geniculate form, and the other destitute of a blade, with the end of the shaft or manubrium, pointed and curved.

Sitka, June 16, very common on rocks and shells, usually associated with bryozoa; Prince William Sound, at Orca, on *Crucigera* tubes; Pacific Grove, California, on small shells.

SPIRORBIS ABNORMIS sp. nov.

Pl. XXXIX, fig. 35; Pl. XL, figs. 1, 2; Pl. XLIII, figs. 24, 28, 29.

Type locality. — Sitka.

Dull, opaque, usually rounded tubes in irregular sinistral coils, the whorls often piling on one another, somewhat resemble some forms of *S. asperatus*.

The operculum differs from that of all other species in having three distinct parts, each with a similar calcareous plate. In some instances the two upper parts have been torn away, leaving one plate in the operculum which is filled with well-developed embryos, each with a conspicuous patch or mass of white, which under pressure separates into minute rods that are soluble in acid. Similar white masses have been found in the embryos in the operculum of the eastern *S. granulatus* and *S. validus*. Their exact significance has not been satisfactorily determined. They apparently have not before been noted.

Setæ finely serrate blades, not very unlike those of *S. asperatus*.

On fragments of rocks with *S. variabilis*.

SPIRORBIS INVERSUS sp. nov.

Type locality. — Port Phillip, Australia.

Isolated, minute, opaque, very lustrous, sinistral tubes, closely allied in form to *S. lucidus*, are attached to the tips of the lower or sheltered branches of a bryozoan (*Menipea cirrata* Lam.?) in the Yale University Museum.

They are remarkable for the turning downward, like a spout, of the more or less elongated terminal portion, but at first form regular flat coils. No definite characters could be obtained from the much-dried animals. No record of such a species has thus far been found.

SPIRORBIS TRIDENTATUS sp. nov.

Type locality. — Port Phillip, Australia.

Associated with *S. inversus* on the bryozoan *Menipea cirrata* are numerous other isolated white tubes which are carinated and dextrally coiled more or less irregularly upward when mature, the margin of the aperture with two deep angular incisions forming three conspicuous angular teeth.

They differ from all known forms in having the lower surface of the whorls distinctly smaller than the upper surface, the sides inclined outward forming a carinated shoulder, with the usually flattened upper surface, on which is a much larger median carina; a third defines a small, deep, central cavity, but in many full-grown specimens the inner one is inconspicuous or wanting. No animals were found.

This species may prove to be either *S. lamellosus* Lam. or *S. incisus* Mörch (*S. carinatus* Lam. *non* Montagu) described by Lamarck in 1818, from King Island, which is south of Port Phillip. The descriptions are inadequate for accurate identification, and the figures by Chenu have not been seen.

NOTES ON SOME PREVIOUSLY DESCRIBED SPECIES OF SPIRORBIS, WITH DESCRIPTIONS OF NEW FORMS FROM THE ATLANTIC.

Spirorbis granulatus Linné 1767. PL. XL, fig. 24; PL. XLIII, fig. 32.

This small species is well figured by Levinsen (1883, PL. III, fig. 9; fig. 10 is a different species). It is very common on bryozoans (*Celleporaria*, *Escharopsis*, *Porella*, etc.) from the Grand Banks of Newfoundland, Gulf of St. Lawrence, and Greenland; though often larger and less regularly coiled it is readily distinguished by the three conspicuous thin lamella-like carinæ. The name, however, has been erroneously applied to several other forms, as the following: *S. granulatus* Fabricius 1780 = *violaceus* Levinsen 1883; *granulatus* Montagu 1803 = *sulcatus* Adams 1797; *granulatus* Langerhans 1880, and probably also that of Saint-Joseph 1894 = *militaris* Claparède 1868; *granulatus* Caullery and Mesnil 1897 = ?; *granulatus* Moore 1902 = triangular form of *quadrangularis* Stimpson 1853.

Spirorbis verruca Fabricius 1822, *non* Levinsen 1883. PL. XLI, figs. 3, 12; PL. XLIV, figs. 1, 16.

Numerous specimens of a good-sized, thick, opaque, white, sinistral tube with spreading base and small central cavity, attached to a valve of *Chlamys islandicus* from Greenland, are identified as *S. verruca*, as they seem to agree more closely with Fabricius' description than the larger form figured by Levinsen (1883). The surface is ornamented with one, sometimes two, small rounded spiral threads, rarely sufficiently prominent to be termed carinæ. In adults, at the upper angle of the inner or columellar margin, the edge of the aperture is tilted upward; sometimes the ends of the threads form obscure projections on the upper edge.

The calcareous plate on the operculum, which becomes a brood-pouch, can scarcely be distinguished from that of *S. validus* Verrill, but the collar setæ differ in being less numerous and in some having an obscure posterior notch.

Specimens on *Nothria* tubes from Greenland, identified by Moore 1902, on examination prove to be the discoid form of *S. validus* V.

Spirorbis vitreus Fabricius 1780. PL. XLI, fig. 14; PL. XLII, figs. 6, 7.

Some immature forms of this dextral hyaline species have a rounded thread or cingulum on the top of the whorls, ending at the aperture in a tooth-like projection.

Found on stones and shells from the Grand Banks of Newfoundland, and on a fragment of shell from Devonshire, England.

Spirorbis cancellatus Fabricius 1780. PL. XXXIX, fig. 36; PL. XL, fig. 27; PL. XLII, figs. 30–34.

A dextral, vitreous, grooved and carinated form, associated with numerous specimens of *S. sulcatus* Adams, is attached to a worn limpet shell from Birterbuy Bay, Ireland. Small notches along the edge of the base indicate the possibility of its proving to be an undeveloped or maturing specimen of *S. cancellatus* Fabr. not before recorded from Great Britain. It may be *S. conicus* Fleming (1825) which Mörch placed as a variety of *S. vitreus* Fabr.

Spirorbis communis Bosc 1802.

No satisfactory conclusion can be reached in regard to this species, owing to the very brief description and indefinite locality. The figure given by Bosc represents a regularly coiled sinistral form with smooth surface, similar to *S. spirorbis* Linné.

Spirorbis corrugatus Montagu 1803, *non* Caullery and Mesnil 1897.

On a stone from Birterbuy Bay, Ireland, are four species of *Spirorbis*. The most numerous form is of good size, sinistral, the last whorl usually covering all the others, forming a central pit; sometimes irregularly coiled, with the aperture turning upward. Surface in perfect condition, very lustrous and smooth, but as this epidermal layer is easily destroyed many of them have the surface roughened by numerous transverse lines, but no spiral ones. These apparently agree with Montagu's description. The dextral form sometimes having spiral lines, identified and figured by Caullery and Mesnil (1897) as this species, must be distinct, for which the name *pseudocorrugatus* is proposed. The form described and figured by Langerhans (1880) is also dextral.

Spirorbis heterostrophus Montagu 1803.

A regularly coiled, small, dextral form has the surface cut by grooves and carinæ which increase with age, so that fully developed specimens are distinctly tricarinate, the entire surface often roughened by transverse lines. Another small dextral form, which is considered distinct, has two, three, or more rounded spiral threads and no grooves. This one does not appear to have been mentioned by Montagu or others. A third dextral form has a single dorsal carina and may prove to be *S. carinatus* Montagu or *S. minutus* Montagu.

Spirorbis carinatus Montagu 1803.

As already stated (p. 241), there is considerable doubt in regard to this species. The form described by Fleming (1825) is certainly very similar to *S. quadrangularis* Stimpson, but it is not improbable that both species occur on the English coast. In the Yale University Museum are two unicarinate, regularly coiled forms, one dextral, attached to a valve of *Anomia* from Guernsey, England, and to a stone from Birterbuy Bay, Ireland, and the other sinistral, attached to a worn valve from England; neither is like the carinate, triangular, immature form of *S. quadrangularis* from Eastport, Maine, and from Greenland.

Spirorbis sulcatus Adams 1797; *S. granulatus* Montagu 1803, *non* Linné 1767. PL. XLI, fig. 9; PL. XLIII, figs. 8, 19.

Attached to a *Haliotis tuberculata* from Guernsey, England, and to a worn limpet shell from Birterbuy Bay, Ireland, are numerous thick, more or less regularly spirally coiled, sinistral tubes, having a deep groove on top of the whorls, when adult, with a large rounded carina on each side, the inner one defining the small central cavity; in very large specimens another much shallower groove appears on the side of the whorl, with a much smaller carina or thread along its lower edge. The surface, when perfect, has considerable luster. This species is much larger and thicker than the dextral tricarinate form identified as *S. heterostrophus*, and is without question the *S. granulatus* Montagu 1803, *non* Linné 1767, and therefore must take the name *sulcatus*, used by Adams 1797 (Linnean Transactions, III, p. 254), *non* Lamarck 1818.

By the use of potash solution the dried animals were taken from some of the tubes, and the calcareous plate on the operculum and the setæ were found.

Spirorbis validus Verrill 1874. PL. XXXVII, figs. 5, 6, 7, 8, 10, 32; PL. XLIV, figs. 11–14.

This, the largest of all species of *Spirorbis*, varies greatly in its manner of coiling, there being a marked contrast between the regular sinistral form figured by Levinsen as *S. verruca* Fabr. and others, where the whorls lie one above the other, forming a high irregular spiral. No difference, however, could be found in the essential characters of their animals. In all the specimens examined, the branchiæ number 13 (in very large adult forms Verrill counted 15) and all the setæ have long, slender, finely serrate, tapered blades.

Spirorbis stimpsoni Verrill 1879. PL. XXXIX, fig. 38; PL. XL, fig. 29; PL. XLIII, figs. 20, 21, 22.

This species forms regularly coiled sinistral tubes with large central cavity, the aperture occasionally turned upward, the surface often roughened by growth lines and a small rounded median thread.

Spirorbis pusilloides nom. nov. for *Mera pusilla* Saint-Joseph 1894.

As the *pusilla* of Saint-Joseph is now referred to the genus *Spirorbis*, and as this specific name was used by Rathke in 1836 for a form from the Black Sea, *S. pusilloides* is proposed for Saint-Joseph's species.

Spirorbis pseudocorrugatus nom. nov. for *S. corrugatus* Caullery and Mesnil 1897, *non* Montagu 1803 (see p. 248).

Spirorbis foraminosus Bush 1904.

Tubes forming a good sized dextral discoid coil, the surface ornamented with 3 carinæ, the median one the most prominent, on both sides of which the slightly concave surface is punctured by irregular minute holes or foramina apparently caused by the erosion of the epidermal layer; immature forms probably having the surface crossed by numerous transverse lines. The operculum, which is a brood-pouch, is elongated, cylindrical, filled with eggs, the calcareous plate a simple disk with flaring rim with large shield-shaped basal portion attached posteriorly to a secondary calcareous disk on the end of the operculum proper. Setæ with simple tapered blades, those on the collar the broadest and more abruptly tapered than the others.

Spirorbis bellulus Bush 1904.

Tube dextral, regularly coiled, with small central cavity, the surface ornamented with 3, sometimes 4, unequal rounded threads, the one on the summit the most prominent. The calcareous plate on the operculum somewhat angular, with deep upright thickened rim. Setæ with long slender tapered blades, those on the collar with comparatively coarse serrations.

Spirorbis dorsatus Bush 1904.

Tube dextral, regularly coiled, with a single high median ridge on the last whorl. No animal found.

Spirorbis argutus Bush 1904.

Tube sinistral, forming a low discoid coil with large central cavity, spreading around the base in a thin layer, the whorl rapidly enlarging and ornamented with one large median keel and numerous distinct

transverse lines. Calcareous plate on the operculum thin, disk-like, slightly thickened in the center. Setæ with simple tapered blades.

Spirorbis tubæformis sp. nov. Pl. XXXIX, figs. 30, 32; Pl. XLII, figs. 13, 14.

Small, opaque, white sinistral tubes common on Irish moss (*Chondrus*) from Long Island Sound, southern New England, at New Haven, Connecticut, closely resemble the dextral *S. sinistrorsus* common on lobsters from Cornwall, England, in the Yale University Museum. The central cavity is smaller than in *S. spirorbis* Linné, not showing so much of the earlier whorls, the last whorl being more spreading or trumpet-shaped. In the adult form, which is rarely found, the surface sometimes becomes roughened by irregular growth lines, and the whorls appear rounder and turn upward after the manner of *S. lucidus*, but in the opposite direction. Collar setæ with fine serrate blades and coarser fin-like bases similar to those of *S. spirorbis*.

Spirorbis evolutus sp. nov. Pl. XLII, figs. 20, 21, 22.

Smooth, opaque, rather fragile sinistral tubes are attached to the inside of the aperture of a shell (*Sipho*) from the Grand Banks of Newfoundland. The early whorls are coiled in a regular discoid form, from which the tube stretches out and becomes evolute, more or less irregularly curved, sometimes twisted, increasing abruptly in size and forming a long, somewhat trumpet-shaped portion. They are usually separated, but sometimes spread over one another. In the five specimens stained and mounted in glycerine, the number of branchiæ is apparently 9, but this is impossible to determine with accuracy, as they have become much matted in preservation. The operculum is of the ordinary form, with the thin calcareous terminal plate having an unusually long, somewhat spreading basal portion. Body-cavity distended with well-developed eggs. Posterior portion very short, number of segments indeterminable; only a few setæ and scarcely discernible uncini were visible. Setæ of the collar fascicle slender, long, rounded at base, with faintly serrate edges, one or two with a slight posterior notch.

Spirorbis formosus sp. nov. Pl. XXXIX, figs. 18, 19; Pl. XLI, fig. 22; Pl. XLIII, figs. 18, 23, 25, 30.

Small, regularly coiled, dextral, yellowish tubes, very common on gulf-weed (*Sargassum*) from the Gulf Stream and Bermuda, where they are also found on shells, are ornamented on top with two or three,

often unequal, spiral threads or carinæ, the interspaces crossed by numerous raised transverse lines which extend over the side, and in fully developed specimens spread around the base. The operculum is furnished with a peculiar calcareous cylinder in which well-developed embryos, some with good sized setæ, have been found. Some specimens collected at Bermuda in February 1904, by Mr. Dwight Blaney, have two complete cylinders, one above the other, on the operculum; others have a single large cylinder filled with well-developed eggs. All the thoracic setæ have narrow tapered blades.

Spirorbis mutabilis sp. nov.

Smaller, more or less regularly coiled sinistral tubes are found on various shells at Bermuda, often with the preceding species.

The surface is usually but little roughened, but sometimes very faint spiral lines occur, and in rare instances, when the development has not been impeded, the surface is ornamented with two keels which define the flattened top, giving a four-sided appearance; sometimes the aperture is turned upward. The operculum is furnished with a thin, more or less concave calcareous plate with small base. Some of the opercula were filled with globular masses and others were of the ordinary form. In some instances egg-chains were found in the tubes along the dorsal furrow. The collar setæ have long, tapered, coarsely serrate blades with conspicuous fin-like bases.

NOTES ON THE GENUS SPIRORBIS, WITH A LIST OF DESCRIBED SPECIES.

The genus *Spirorbis* seems to have been purposely avoided by most authors, little systematic work having been done since Mörch, in 1863, published the descriptions, with added notes, of all of the earlier described species, straightening out much of the confusion in their synonymy.

Levinsen, in 1883, was the first to make a thorough study of the northern species, by dissecting the animals, and has, by his excellent figures of their tubes and important collar setæ, done much toward rendering it possible to correctly identify them.

As little had been published in regard to the importance of the operculum, with its protective calcareous plate, in connection with the writer's study of the Alaska species, the animals of numerous Atlantic forms found along the coast from Greenland to Bermuda have been dissected with special reference to this character. The investigations were

completed before the valuable article[1] on *Spirorbis*, published by Caullery and Mesnil in 1897, could be consulted. It was found that these authors had made special and careful observations on the opercula, with their calcareous plates, of many species, giving excellent figures, as well as figures of the important collar setæ. In connection with their studies of material obtained at the laboratories of St.-Vaast-la-Hougue on the English Channel, and from the French Expedition to Cape Horn, these authors also borrowed specimens from the Museum of Copenhagen (from Levinsen), the Paris Museum, and the Faculty of Science of Lyons, besides special species from Marenzeller and Marion, so that their list includes 27 species, 12 of which are described as new, and their results far exceed in value any hitherto published. Owing to the limited time allowed for the perusal of this paper, only the most important facts could be noted, and it has been found impossible to determine to what degree the following observations may be a repetition of those of Caullery and Mesnil.

In those species in which the embryos are developed in the tube, as in *S. spirorbis* Linné, *S. spirillum* Linné, *S. asperatus* sp. nov. etc., the operculum is used simply as an organ of protection in closing the aperture of the tube; while in others, as *S. granulatus* Linné, *S. validus* Verrill, *S. stimpsoni* Verrill, *S. quadrangularis* Stimpson, etc., it has an added purpose, by being differentiated into a thin-walled, pouch-like cavity in which the embryos are fully developed. It is protected on the end by a calcareous plate or cap, varying in form, having near its inner or ventral edge a more or less developed basal portion. In species where there is but a slight basal thickening, as *S. semidentatus* sp. nov., the plate appears to be more or less embedded in the operculum, and minute protozoans, sponges, etc., are often affixed to its exposed surface; but in others, where there is an elongated, more or less shield-shaped base, special muscles are joined to the free end, apparently governing the movement of the plate, as they appear to extend downward through the peduncle to the muscular layer of the body, such muscle fibers often remaining attached when the plate has been dissected. When the operculum becomes differentiated into a brood-pouch a larger basal portion develops, which is usually shallow behind and long in front, sometimes reaching nearly the depth of the operculum, forming a stiff wall, thus protecting the

[1] Considerable difficulty was experienced in obtaining a copy of this article; as lack of time prevented application to the authors themselves, it was borrowed by Mr. Van Name, the Librarian of the University Library, from the Surgeon General's Office in Washington, D. C.

embryos. In some instances this appears to be simply an addition over or in front of the first base, and in others an entirely new plate develops, which pushes the primary one forward until it becomes entirely disconnected and ultimately lost. A series showing this interesting feature was found in *S. validus* V. (PL. XLIV, fig. 14). In some instances this second base appears to be formed by a network of calcareous deposit over the surface of that portion of the operculum, and in others it seems to be composed of minute granules. In some instances the primary plate itself is repeated, as in *S. variabilis* sp. nov., where the calcareous disk is composed of two layers easily separable into two complete disks (PL. XLIII, fig. 16), and in *S. abnormis* sp. nov., where there were three similar plates, attached one above the other, the operculum itself appearing to be divided into three chambers, the posterior one containing well-developed embryos (PL. XLIII, figs. 24, 28, 29). In *S. formosus* sp. nov., where nearly the entire operculum becomes a calcareous cylinder, the primary base was seen inside the cylinder (PL. XLIII, fig. 30), when this was severed from its peduncle, and another plate in process of development was found in the expanded end (PL. XLIII, fig. 23), which apparently was to become another operculum; two complete cylinders have also been found attached one above the other. This and other instances where the brood-pouch, apparently having split along the back and discharged its embryos, was becoming torn away, revealing a calcareous disk beneath it, points to the fact that in *Spirorbis* the animal has the power of renewing its operculum on the same side of the body, instead of forming a secondary one on the opposite side, as in *Serpula*, *Crucigera*, etc. Caullery and Mesnil found a close relationship between the direction of the coiling of the tube and the development of the animal; that all dextral forms had the operculum on the right side and all sinistral ones on the left side, presumably differentiated from the second branchia. It would therefore seem improbable that any species could turn in both directions, that is, have both a right and left form, an opinion held by some investigators; hence the direction of the coiling of the tube is of first importance in determining species.

The embryological development of a number of species has been studied by several authors — Pagenstecher 1862 (*S. pagenstecheri* Qtr. 1865); Agassiz 1866 + Willemoes-Suhm 1871 + Saint-Joseph 1894 + Schively 1897 (*S. spirorbis* L.); Claparède 1868 (*S. lævis* Qtr.), Fewkes 1885 (*S. spirillum* L.); Saint-Joseph 1894 (*S. pusilloides* nom. nov.)—and hermaphroditism has been found to be the rule. Nearly all agree that the spermatozoa are carried in the posterior

setigerous segments, some maintain that the ova are found only in the first two or three of these segments, others that they occur only in the middle or body-cavity, which ruptures along its convex side, permitting the eggs to escape into the tube, where they are developed. In preserved specimens of *S. spirorbis* strings or chains of embryos showing well-formed setæ have been found lying along the back, apparently coming from an opening in the body-cavity just back of the thorax. In several specimens, when stained and mounted, eggs showing nucleus and nucleolus have been seen in both the body-cavity and (smaller ones) in the first few posterior segments, but no spermatozoa were noticed, the posterior segments being usually filled with minute granules (oil drops?), with the mucous glands on their dorsal surface very conspicuous, especially when eggs were found in the tube. Miss Schively, however, who carried on her investigations during two seasons, examining specimens from eight different localities in Vineyard Sound and Buzzard's Bay, states "that *S. borealis* has two breeding seasons. One of these extends from the middle of June to the middle of July; the other extends through the month of August. During the last two weeks of July no eggs were found either in the body-cavity or in the shell." "The eggs pass out through the operculum; its end bears a movable translucent plate of lime, etc." "The reproductive glands are arranged on either side of the intestinal canal near the stomach. Where the ova and sperm is developed is distinguished merely by the presence of the product. The eggs pass into the body-cavity and from here into the operculum, where they are fertilized and a capsule is secreted; from here they pass out through the opening of the operculum and are placed in the mid-dorsal furrow. The operculum does not serve for a brood-pouch as does that of *S. spirillum*." She probably refers to the species studied by Pagenstecher in 1862, which he erroneously identified as *S. spirillum*, to which Quatrefages in 1865 gave the name *S. pagenstecheri*. In the many specimens recently examined, of *S. spirillum* Linné detached from kelp (*Laminaria*), chains of eggs have been found in the tube. This is supposed to be the species studied by Fewkes in 1885, as *S. borealis;* the *S. spirillum* of Agassiz (1866) is *S. borealis* Daudin = *S. spirorbis* Linné.

Saint-Joseph (1894) states that he found in *Mera pusilla* (*Spirorbis pusilloides* nom. nov.) not only well-developed embryos in the operculum, but large ova in the first two abdominal segments and spermatozoa in the following ones. In one instance only were spermatogonia and spermatozoa seen (see Addendum); but the other features were noted

in many of the species studied. In *S. validus* collected the latter part of June, also in *S. granulatus*, the embryos taken from the operculum had the setæ well developed, and each was partially concealed by a conspicuous white patch, which under pressure split into minute short rods, quickly destroyed by acid. The exact significance of this white patch has not been satisfactorily determined, owing to its being now noted, apparently for the first time, in preserved animals. It is a well-known fact that embryos developed in the tube of the parent, on escaping, immediately on reaching a suitable host, begin to build their tubes, so that it might be possible that these embryos, when the specimens were collected, were about escaping from the pouch, and that their growth or movements were not immediately interrupted and the lime was formed which would have constructed their tubes. On the other hand, the mass may cause the embryo to sink rapidly, enabling it more readily to find a host, as it must necessarily escape from the brood-pouch into the open sea, at some distance from a suitable object for attachment. Not until a series of animals has been properly prepared in sections, and a comparative study is made of many species, will it be possible satisfactorily to determine their internal structure. It is found in comparing the published results of the studies of isolated species that there are apparent contradictions, and important points remain unexplained.

Caullery and Mesnil, like Levinsen, found that the number of thoracic segments varied, sometimes increasing to 4 on one side; combining this fact with that of the development of the operculum on the right or left side, they divided the genus *Spirorbis* into new subgenera — *Paradexiospira*, *Dexiospira*, *Paralæospira*, *Læospira* and *Romanchella* — discarding all of Saint-Joseph's generic names, excepting *Leodora*, which they thought might prove to be the same as the last, stating that they were unable to follow that author in referring the species to his six widely separated genera.

As it is impossible always accurately to determine the number of thoracic segments, often owing to the very poor condition of the animals in preservation, such a division, although of much interest, does not appear of any more practical value in determining the relationship of species than does the method adopted by Saint-Joseph. The analytical table of species given by these authors includes too many characters to be readily used.

Saint-Joseph (1894), in his analytical table for the Serpulas, makes the number and size of the teeth on the uncial plates of greatest importance. He seems, however, to have erred in describing and figur-

ing the uncial plates of *Spirorbis borealis* Daudin as having the lowest tooth larger than the others, as this does not appear to be the case in any of the species studied. The embedded portion does not extend to the end of the thicker surface plate, on which the teeth seem evenly spaced. He bases his subordinate divisions on the differences in form, not only of the collar setæ, but of all the others, with the result that species of *Spirorbis* are widely separated and referred to other genera, as instanced in the following:

Spirorbis, with *S. borealis* Daudin as type, is placed under his second grand division with *Filograna* Oken, *Salmacina* Claparède, and *Filogranula* Langerhans. *Spirorbis granulatus* Linné is referred to *Pileolaria* Claparède, type *P. militaris* Clap.; *S. pagenstecheri* Quatrefages to *Janua* gen. nov. as type; *S. corrugatus* Montagu and *S. lucidus* Montagu to *Circeis* gen. nov., type *C. armoricana* Saint-Joseph; *S. lævis* Quatrefages to *Leodora* gen. nov. as type.

It can be readily seen by this and a further study of the relative positions of these genera that such an arrangement can be adopted only by ignoring the generic importance, not only of the presence of a calcareous plate in the operculum, but also the number of thoracic segments.

The few odd setæ — long blades with deeply serrate (comb-like) ends, similar to those of *Apomatus*[1] Philippi 1844 (type, *A. ampulliferus*), and short setæ like those of *Salmacina* Claparède 1870 (type, *S. incrustans*) — said to be found on the second and third thoracic segments are also given generic value. In the large number of animals examined, however, only the long form has been noticed in the third fascicle, although in a few instances these varied in length in the same bundle, but they were not always found. Whether they simply failed to show in the mounting, or really do not always occur, or occurring only during the breeding season are easily lost, has yet to be determined; therefore it seems undesirable to make them of much importance. Caullery and Mesnil (1897) arrived at the same conclusion, and, finding it impossible to follow Saint-Joseph, discarded five of his generic names, but proposed other subgeneric ones based on different characters (see p. 256).

As the form of the superior collar setæ is of first importance in identifying species, and with care can be invariably determined even in very poorly preserved specimens, an attempt has been made to de-

[1] These are also very like some of the dorsal setæ found in *Amphitrite*, as figured by Saint-Joseph (1894).

vise a simple method of arranging the various species, based on this character. By comparing the different forms, which vary from narrow tapered blades to those having a conspicuous fin-like base, they are found to grade into one another, and fall into the following natural divisions or groups, to which apparently Saint-Joseph's names can be applied:

A. In the forms having the distinct fin-like base, the fin angular or rounded, there are apparent differences in the serrations, which are separable into two groups. In the first the serrations on the edge of the blade are comparatively fine and the spines on the fin usually much coarser (PL. XL, fig. 12). Taking *Spirorbis borealis* Daudin, now considered synonymous with *S. spirorbis* Linné, as the type species, there should be a few (3 to 5) odd setæ with elongated fringed ends in the third fascicle of thoracic setæ. This is *Spirorbis* in its strictest sense.

B. In the second form the serrations become very coarse on both the blade and fin (PL. XXXVII, fig. 24). As *militaris* Claparède falls into this group, it is equal to the genus *Pileolaria* Claparède + Saint-Joseph, which, according to the latter, has no odd setæ.

C. The form with rounded fin gives rise to those in which the fin is defined only by a more or less definite notch, which entirely disappears, forming simple tapered blades (PL. XLI, fig. 3). In this group are both *pagenstecheri* Quatrefages, referred to *Janua* by Saint-Joseph as type, and *pusillus* Saint-Joseph, referred to *Mera* as type. The first is described as having the odd setæ of *Apomatus* on one or more segments, while the second has them on the third only, so that there seems to be no distinguishable difference between them, except in the form of the operculum. *Mera* therefore becomes synonymous with *Janua*, the name of this third group.

D. The form with angular fin gives rise to a simple blade, broadly angular at base, found in *armoricanus* Saint-Joseph, referred to *Circeis* as type (PL. XLI, figs. 1, 2).

E. Instead of being angular, the blade becomes broadly rounded at base, as in *lævis* Quatrefages, referred by Saint-Joseph to *Leodora* as type. Caullery and Mesnil suggested the possibility of this proving synonymous with the following group.

F. The blades become long, narrow, regularly tapered, and similar in all three fascicles, as in *perrieri* Caullery and Mesnil, the type of *Romanchella* Caullery and Mesnil (PL. XXXVII, fig. 8).

None of these groups or divisions are sufficiently disconnected or distinct to give them generic (after Saint-Joseph) or subgeneric (after Caullery and Mesnil) value. But since the names have been proposed,

they are retained only as sectional ones in the following table (p. 261), especially as setæ of similar forms are found in genera which differ from *Spirorbis* in the number of thoracic segments, in the form and substance of the plate in the operculum, and in some instances in lacking an operculum.

As a large number of species are known only by their tubes, the animals of comparatively few having been studied with reference to the form of their collar setæ, two simple methods have been adopted in grouping them, as a possible aid to their correct identification: One based on a knowledge of the tube (see p. 260), and the other on the form of the superior collar setæ (see p. 261).

Levinsen (1883) used the terms 'sinistral' and 'dextral' in grouping the northern species, but also retained (after Mörch) the substance[1] of the tube as an equally important character. As this, however, is found to change sometimes with growth, and also to be more or less affected in preservation, it cannot always be defined with accuracy, and might prove misleading. Therefore the direction of the coil and the character of the surface of the tube are the only points considered in the first table.

To avoid repetition and confusion of names, a list of all the recognized species, as far as known, is given after the two tables. They are arranged chronologically, and with each is given its principal synonyms and reference to figures, also the principal localities at which it has been found. As the numerals used by Caullery and Mesnil in their recent and very important work (1897) show the arrangement of species in their subgeneric relation as well as to one another, this number is given after the names of these authors. Names with an asterisk show that the species has been studied and is in the Yale University Museum.

Of the 73 species cited, only 59 could be placed in the first table, although the position of some of these may be questioned, and but 41 in the second table. The necessary further study of the others may prove some of them to be but synonyms there being 14 species having the tube inadequately described and 32 about which nothing is apparently known of the animal.

[1] Crystalline, vitreous, cretaceous, porcellanous, etc., have been used.

TABLE I.

BASED ON CHARACTER OF SURFACE OF TUBE, WHICH, WHEN FULLY DEVELOPED, IS SMALL, MORE OR LESS REGULARLY COILED, DISCOID, ASCENDING, OR SPREADING.

A. Surface without lines or grooves.

Tube sinistral.

Spirorbis spirorbis Linné (18)[1]
communis Bosc.
corrugatus Montagu *non* C. & M.
chilensis Gay (surface?).
lævis Quatrefages.
validus Verrill (17).
mörchi Levinsen (27).
aggregatus C. & M. (10).

Spirorbis claparedei C. & M. (11).
nordenskjöldi Ehlers (surface ?).
similis sp. nov.
abnormis sp. nov.
inversus sp. nov.
tubæformis sp. nov.
evolutus sp. nov.

Tube dextral.

Spirorbis spirillum Linné (4).
sinistrorsus Montagu.

Spirorbis armoricanus Saint-Joseph (5)
pusilloides nom. nov. (9).

B. Surface variable: with and without lines.

Tube sinistral.

Spirorbis verruca Fabr. *non* Levinsen.
quadrangularis Stimpson.
malardi C. & M. (12).
lebruni C. & M. (14).

Spirorbis levinseni C. & M. (15).
asperatus sp. nov.
mutabilis sp. nov.

Tube dextral.

Spirorbis vitreus Fabr. (2).
pseudocorrugatus nom. nov. (7).
semidentatus sp. nov.

Spirorbis rugatus sp. nov.
incongruus sp. nov.

C. Surface with distinct lines and grooves.

Tube sinistral.

Spirorbis granulatus Linné.
carinatus Montagu.
sulcatus Adams.
cornuarietis Philippi (20).[2]
militaris Claparède (24).
stimpsoni Verrill.
beneti Marion (21).
patagonicus C. & M. (13).

Spirorbis perrieri C. & M. (16).
mediterraneus C. & M. (19).
kœhleri C. & M. (22).
bernardi C. & M. (23).
langerhansi C. & M. (26).
argutus Bush.
variabilis sp. nov.
lineatus sp. nov.

Tube dextral.

Spirorbis cancellatus Fabr. (1).
heterostrophus Montagu.
violaceus Levinsen (3).
marioni C. & M. (6).
pagenstecheri Quatrefages (8).
foraminosus Bush.

Spirorbis bellulus Bush.
dorsatus Bush.
eximius sp. nov. (direction?).
comptus sp. nov.
tridentatus sp. nov.
formosus sp. nov.

[1] See pp. 236 and 262.

[2] See Addendum.

TABLE II.

BASED ON FORM OF SUPERIOR COLLAR SETÆ.

A. Setæ having a long tapered blade preceded by a fin-like expansion.

Spirorbis Daudin 1800.

a. Serrations on the blade fine, usually much finer than on the fin.

Spirorbis Daudin 1800 st. s.

Tube sinistral.

Spirorbis spirorbis Linné (18).[1]
granulatus Linné.
sulcatus Adams.
quadrangularis Stimpson.
stimpsoni Verrill.
aggregatus C. & M. (10).
claparedei C. & M. (11).
malardi C. & M. (12).
Spirorbis patagonicus C. & M. (13).
lebruni C. & M. (14).
kœhleri C. & M. (22).
bernardi C. & M. (23).
lineatus sp. nov.
similis sp. nov.
tubæformis sp. nov.

b. Serrations on the blade coarse, similar on fin.

Pileolaria Claparède 1870.

Tube sinistral.

Spirorbis cornuarietis (Philippi) (20).
militaris Claparède (24).
mörchi Levinsen (27).
levinseni C. & M. (15).
mediterraneus C. & M. (19).
Spirorbis beneti Marion (21).
langerhansi C. & M. (26).
mutabilis Bush.
variabilis sp. nov.

Tube dextral.

Spirorbis cancellatus Fabr. (1).
vitreus Fabr. (2).
marioni C. & M. (6).
Spirorbis semidentatus sp. nov.
eximius sp. nov. (direction?).
incongruus sp. nov.

B. Setæ having the blade of two forms: with and without a shallow posterior notch.

Janua Saint-Joseph + *Mera* Saint-Joseph 1894.

Tube sinistral.

Spirorbis verruca Fabr. *non* Levinsen.
Spirorbis evolutus sp. nov.

Tube dextral.

Spirorbis pagenstecheri Quatr. (8).
Spirorbis pusilloides nom. nov. (9).

C. Setæ having the blade distinctly angulated at base.

Circeis Saint-Joseph 1894.

Tube dextral.

Spirorbis spirillum Linné (4).
violaceus Levinsen (3).
Spirorbis armoricanus Saint-Joseph (5).

D. Setæ having the blade broadly rounded at base.

Leodora Saint-Joseph 1894.

Tube sinistral.

Spirorbis lævis Quatrefages.

Tube dextral.

Spirorbis pseudocorrugatus nom. nov. (7).
Spirorbis rugatus sp. nov.
comptus sp. nov.

[1] See p. 258.

E. Setæ having the blade regularly tapered.

Romanchella Caullery and Mesnil 1897.

Tube sinistral.

Spirorbis validus Verrill (17).
perrieri C. & M. (16).
argutus Bush.

Spirorbis asperatus sp. nov.
abnormis sp. nov.

Tube dextral.

Spirorbis foraminosus Bush.
bellulus Bush.

Spirorbis formosus sp. nov.

SPECIES OF SPIRORBIS ARRANGED IN ORDER OF DATE OF PUBLICATION.

An asterisk [*] after the name of a species indicates that specimens are in the Yale University Museum.

1760. SPIRORBIS SPIRORBIS* Linné + Fabricius 1780 + Montagu 1803, in part, + Cuvier (figures). (See pp. 236 and 258.)

borealis Daudin 1800 + Mörch 1863 + Malmgren 1867 + Levinsen 1883 (figures) + Saint-Joseph 1894 (figures) + Caullery and Mesnil 1897 (18; figures) + ? Schively 1897 (embryology; figures).

nautiloides Lamarck 1818 + Willemoes Suhm 1871 (embryology; figures).

spirillum Agassiz 1866 (embryology; figures) *non* Linné.

Pl. XXXIX, fig. 34; Pl. XL, figs. 5, 6, 8, 12–15; Pl. XLII, figs. 15–19.

Northern waters, on stones and rock-weed (*Fucus*); ? on other hosts.

1760. S. SPIRILLUM* Linné + Fabricius 1780 + ? Montagu 1803 + ? Mörch 1863 + Malmgren 1867 + Levinsen 1883 (figures) + Caullery and Mesnil 1897 (4) + Moore 1902. (See p. 243.)

lucidus Montagu 1803 (figures) + Mörch 1863 + Malmgren 1867 + Saint-Joseph 1894; variety *grönlandicus* Mörch 1863 (*porrecta* Fabricius 1780 *non* Müller).

borealis Fewkes 1885 (embryology; figures) *non* Daudin 1800.

Pl. XXVII, fig. 8; Pl. XXXIII, fig. 15; Pl. XXXIX, figs. 21–23, 28; Pl. XL, fig. 7; Pl. XLII, figs. 1–5; Pl. XLIII, figs. 9, 10.

Northern waters, very common, both Atlantic and Pacific; from Cape Cod, Massachusetts, coast of New England to Greenland, and from Bering Sea to California, from shallow water to 90 fathoms, on shells (*Buccinum*, *Sipho*, etc.), on algæ (*Laminaria*, etc.), on bryozoans (*Cellularia*, *Crisia*, *Gemellaria*, *Bugula*, etc.), on hydroids (*Obelia*, *Salacia*, *Eudendrium*, *Sertularia*, *Thuiaria*, etc.), and on worm tubes (*Nothria*, etc.); England, on bryozoans (*Salicornaria*, etc.).

1767. S. GRANULATUS* Linné + Mörch 1863 + Malmgren 1867 + Levinsen 1883, in part (tab. III, f. 9 not 10), *non* Fabricius 1780 + Montagu 1803 + Langerhans 1880 + Saint-Joseph 1894 + Caullery and Mesnil 1897 (25; figure) + Moore 1902. (See p. 247.)

Pl. XL, fig. 24; Pl. XLIII, fig. 32.

Northern waters, from Bay of Fundy, Grand Banks of Newfoundland, Gulf of St. Lawrence, and Greenland, on bryozoans (*Celleporaria*, *Porella*, *Escharopsis*, etc.).

1780. S. VITREUS * Fabricius + Mörch 1863 + Malmgren 1867 + Levinsen 1883 (figures) + Caullery and Mesnil 1897 (2 ; figures) + Moore 1902. (See p. 247.)

Pl. XLI, fig. 14 ; Pl. XLII, figs. 6, 7.

Northern waters, from Grand Banks of Newfoundland, in 59 to 120 fathoms, on stones and shells (*Sipho*, *Buccinum*, etc.) ; Greenland, on shells (*Chlamys islandicus*), bryozoans, and worm tubes (*Nothria*, etc.) ; Devonshire, England, on shells.

1780. S. CANCELLATUS * Fabricius + Dawson 1860 (figures) + Mörch 1863 + Malmgren 1867 + Levinsen 1883 (figures) + Caullery and Mesnil 1897 (1 ; figures). (See p. 248.)

Pl. XXXIX, fig. 36 ; Pl. XL, fig. 27 ; Pl. XLII, figs. 30–34.

Northern waters, Gulf of St. Lawrence, Grand Banks of Newfoundland to Greenland, on stones and shells (*Chlamys islandicus*); Birterbuy Bay, Ireland, on limpet shells.

1797. S. SULCATUS * Adams + Mörch 1863 (in synonymy). (See p. 249.)
granulatus Montagu 1803 *non* Linné 1767.

Pl. XLI, fig. 9 ; Pl. XLIII, figs. 8, 19.

England, on shells.

1800. S. TRANSVERSUS Daudin (figures) + Mörch 1863.

Indian Ocean, on marine plants and shells.

1802. S. COMMUNIS Bosc (figures) + Mörch 1863, *non* Chenu + Fleming 1825. (See p. 248.)

Open ocean, on *Fucus*.

1803. S. CARINATUS Montagu + Mörch 1863, *non* Lamarck 1818 + Levinsen 1883. (See p. 249.)

England, on stones and shells (*Ostrea*, *Pinna*, *Trochus*, *Arca*, etc.).

1803. S. CORRUGATUS * Montagu + Mörch 1863 + Saint-Joseph 1894 *non* Langerhans 1880 (figures) + Caullery and Mesnil 1897 (7 ; figures). (See p. 248.)

England and Ireland, very common on stones and shells, with *Lepralia*.

1803. S. HETEROSTROPHUS * Montagu (figure) + Mörch 1863. (See p. 248.)

England and Ireland, on stones and shells, with *Lepralia*.

1803. S. SINISTRORSUS * Montagu + Mörch 1863 (in synonymy) + Chenu (figure). (See p. 251.)

England, on lobsters.

1803. S. MINUTUS Montagu + Mörch 1863. (See p. 248.)

England, on calcareous alga (*Corallina officinalis*).

1808. S. PLICATUS Montfort + Mörch 1863.[1]
Serpula rugosa Chenu (figures) *non* Turton.
Mediterranean, very common on algæ, crustaceans, etc.

1818. S. TRICOSTALIS Lamarck + Mörch 1863 + Chenu (figure).
King George Sound (Port Rio Georges), western Australia.

1818. S. LAMELLOSUS Lamarck + Mörch 1863 + Chenu (figure).
King's Island, Australia.

1822. S. VERRUCA * Fabricius + Mörch 1863 *non* Levinsen 1883 (figures) + Caullery and Mesnil 1897 (17) + Moore 1902. (See p. 247.)
Pl. XLI, figs. 3, 12; Pl. XLIV, figs. 1, 16.
Greenland, on shells (*Chlamys islandicus*), and Grand Banks of Newfoundland, on stones.

1825. S. MONTAGUI Fleming + Mörch 1863.
Spirorbis sp. Montagu 1803.
Guernsey, England, on shell (*Haliotis tuberculata*), very common.

1830. S. ANTARCTICUS Lesson (figure) + Mörch 1863 + Chenu (figure).
Isle of Malouines, very common.

1830 and 1841. S. PONTICUS Eichwald (figure) + Mörch 1863.
Black Sea, on *Fucus* and other algæ.

1836. S. PUSILLUS Rathke + Mörch 1863 *non* Saint-Joseph 1894 + Caullery and Mesnil 1897 (9).
Black Sea, near Balaklava, on stones and shells (*Mytilus*).

1843. S. ZELANDICUS Gray + Mörch 1863.
Great Barrier Island, New Zealand, on shell (*Patella hookeri*).

1844. S. CORNUARIETIS * Philippi (figure) + Mörch 1863 + Marion and Bobretzki 1875 (figures) + Caullery and Mesnil 1897 (20).
Mediterranean, English Channel (coast of France), on stones and coralline (*Lithothamnion polymorphum*).

1849. S. CHILENSIS Gay + Mörch 1863 (figure, Sowerby Ill. *Fissurella*) + Ehlers 1901.
Chili.

1853. S. QUADRANGULARIS * Stimpson + Mörch 1863. (See p. 241.)
fabricii Malmgren 1867.
carinatus Levinsen 1883 (figures) *non* Montagu 1803.
affinis Levinsen 1883 (figure) + 1886.
granulatus Caullery and Mesnil 1897, in part, + Moore 1902.
Pl. XXXIX, fig. 37; Pl. XL, figs. 10, 11, 21, 23, 26, 30; Pl. XLII, figs. 23–29; Pl. XLIII, figs. 14, 15.
Northern waters, Atlantic and Pacific, on stones, shells (*Chlamys islandicus*, *Buccinum*, etc.), bryozoans, and worm tubes (*Nothria*, *Thelepus*,

[1] This and other species said to be in the Museum of Paris and figured by Chenu, 'Illustrationes de Conchyliologie,' do not appear to have been mentioned by Caullery and Mesnil 1897.

Crucigera, etc.), from low water to 120 fathoms. Coast of New England, from Cape Cod, Massachusetts, to Bay of Fundy, Gulf of St. Lawrence; Grand Banks of Newfoundland, Greenland, and Alaska.

1860. S. SIMPLEX Grube + Mörch 1863.

Mediterranean.

1863. S. POROSUS Mörch + Chenu (figure).

Habitat ?

1863. S. INCISUS Mörch.

carinatus Lamarck 1818 + Chenu (figure) *non* Montagu 1803.

King's Island, Australia.

1863. S. ALBUS Mörch + Chenu (figure).

Sea of India.

1865. S. PAGENSTECHERI Quatrefages + ? Langerhans 1880 (figures) + ? Saint-Joseph 1894 + ? Caullery and Mesnil 1897 (8 ; figures).

spirillum Pagenstecher 1862 *non* Linné 1760.

Cette, Gulf of Lyons, Madeira, Mediterranean ; England ?

1865. S. LÆVIS Quatrefages (figures) + Claparède 1868 (figures) + Saint-Joseph 1894.

Guettary, near Saint-Jean-du-Luz, Bay of Biscay.

1868. S. MILITARIS Claparède (figures) + Saint-Joseph 1894 + Caullery and Mesnil 1897 (24 ; figures).

granulatus Langerhans 1880 (figures) (*teste* Caullery and Mesnil 1897) + ? Saint-Joseph 1894 *non* Linné 1767.

France (English Channel), Madeira, Naples, on stones and coralline (*Lithothamnion*).

1874. S. VALIDUS * Verrill. (See p. 249.)

verruca Levinsen 1883 (figures) + Caullery and Mesnil 1897 (17) + Moore 1902.

Pl. XXXVII, figs. 5–8, 10 ; Pl. XLIV, figs. 11–14.

Northern waters, on stones, shells (*Chlamys islandicus*, *Sipho*, *Buccinum*, etc.), and worm tubes (*Nothria*), from 25 to 67 fms. ; La Have Bank, Halifax Harbor, Nova Scotia ; Grand Banks of Newfoundland, and Greenland.

1879. S. STIMPSONI * Verrill. (See p. 250.)

nautiloides Stimpson 1853 + Verrill 1874 (figure) *non* Lamarck 1818.

Pl. XXXIX, fig. 38 ; Pl. XL, fig. 29 ; Pl. XLIII, figs. 20–22.

New England coast, from Eastport, Maine, Bay of Fundy, to Massachusetts Bay, on stones and shells, from 10 to 160 fathoms.

1879. S. BENETI Marion (figures) + Caullery and Mesnil 1897 (21).

Marseilles, Gulf of Lyons, on crinoid (*Antedon phalangium*).

1883. S. MÖRCHI * Levinsen (figures) + Caullery and Mesnil 1897 (27). (See p. 240.)

Pl. XXXVII, figs. 15, 24; Pl. XLI, figs. 15, 16, 21, 24, 25; Pl. XLIV, figs. 20, 21.

Atlantic and Pacific ; Grand Banks of Newfoundland and Greenland, on shells (*Chlamys islandicus*); Alaska, on worm tubes (*Crucigera*) and shells;

and Queen Charlotte Island, British Columbia, on shells (*Pachypoma gibberosum*).

1883. S. VIOLACEUS* Levinsen (figures) + Caullery and Mesnil 1897 (3; figures). (See p. 242.)
granulatus Fabricius 1780 *non* Linné 1767.
Pl. XLI, figs. 1, 2; Pl. XLII, figs. 8–12.
Atlantic and Pacific; Grand Banks of Newfoundland and Greenland, on stones and shells (*Chlamys islandicus*); Alaska, on worm tubes (*Crucigera*) and shells; and Queen Charlotte Island, British Columbia, on shells (*Pachypoma gibberosum*).

1894. S. ARMORICANUS Saint-Joseph (figures) + Caullery and Mesnil 1897 (5; figures).
? sinistrorsus Montagu 1803, in part.
France, on lobsters.

1897. S. MARIONI* Caullery and Mesnil (6; figures). (See p. 239.)
Pl. XXXIX, figs. 26, 27; Pl. XL, fig. 16.
La Paz, Lower California, to Mexico, on sea-urchins (*Cidaris thouarsi*), shells (*Crucibulum*, *Barbatia*, *Callopoma*, etc.), and other hosts.

1897. S. AGGREGATUS Caullery and Mesnil (10; figures) + Ehlers 1901.
Patagonia, in masses.

1897. S. CLAPAREDEI Caullery and Mesnil (11; figures) + Ehlers 1901.
Patagonia, on algæ and shells (*Modiolarca*).

1897. S. MALARDI Caullery and Mesnil (12; figures).
St. Vaast-la-Hougue, France, on shells.

1897. S. PATAGONICUS Caullery and Mesnil (13; figures) + Ehlers 1901.
Patagonia, on nullipore.

1897. S. LEBRUNI Caullery and Mesnil (14; figures) + Ehlers 1900 + 1901.
Patagonia, on sea-urchins (*Goniocidaris canaliculata*); Puerto Toro, from 20 to 25 fathoms.

1897. S. LEVINSENI Caullery and Mesnil (15; figures) + Ehlers 1901.
Patagonia, Straits of Magellan.

1897. S. PERRIERI Caullery and Mesnil (16; figures) + Ehlers 1900 + 1901.
Patagonia, very abundant on sea-urchins (*Echinus margariticeus*, *Goniocidaris caniculata*, etc.), on algæ (*Laminaria*, etc.), on shells (*Modiolarca fuegensis*, *Pecten flustris*, etc.); Punta Arenas, Puerto Churucca, from 20 fathoms, and Beagle Channel.

1897. S. MEDITERRANEUS Caullery and Mesnil (19; figures).
Mediterranean, on *Serpula* tubes.

1897. S. KŒHLERI Caullery and Mesnil (22; figures).
Mediterranean, on bryozoans.

1897. S. BERNARDI Caullery and Mesnil (23 ; figures).
Probable origin Indian Ocean, on sea-urchin (*Cidaris metularia*).

1897. S. LANGERHANSI * Caullery and Mesnil (26 ; figures). (See p. 240.)
Panama to Central America, on sea-urchins (*Cidaris thouarsi*) and shells (*Callopoma*, *Crucibulum*, *Barbatia*, etc.).

1900. S. NORDENSKJÖLDI Ehlers + 1901.
Punta Delgada, Patagonia.

1904. S. FORAMINOSUS * Bush (figures). (See p. 250.)
Japan, on red algæ, in 34 fathoms.

1904. S. BELLULUS * Bush (figures). (See p. 250.)
Japan, on pebbles and fragments of shells, in 63 to 75 fathoms.

1904. S. DORSATUS * Bush. (See p. 250.)
Japan, on fragments of shells, in 63 to 75 fathoms.

1904. S. ARGUTUS * Bush (figures). (See p. 251.)
Japan, on red algæ, in 34 fathoms.

1904. S. PSEUDOCORRUGATUS nom. nov. (See p. 250.)
corrugatus Caullery and Mesnil 1897 (7 ; figures) + ? Langerhans 1880 *non* Montagu 1803.
Madeira and Gulf of Naples.

1904. S. PUSILLOIDES nom. nov. (See p. 250.)
pusillus Saint-Joseph 1894 (figures) + Caullery and Mesnil 1897 (9 ; figures) *non* Rathke 1836.
St.-Vaast-la-Hougue, France.

1904. S. SEMIDENTATUS * sp. nov. (See p. 237.)
Pl. XXVII, figs. 7, 10 ; Pl. XLI, figs. 13, 17, 23, 26–30 ; Pl. XLIII, figs. 4, 5, 12.
Alaska (Sitka, Prince William Sound, and Unalaska Island), on rocks, stones, and worm tubes (*Serpula* and *Crucigera*).

1904. S. VARIABILIS * sp. nov. (See p. 238.)
Pl. XXIX, fig. 3, *a* ; Pl. XXXIX, figs. 24, 25 ; Pl. XL, fig. 4 ; Pl. XLIII, fig. 16 ; Pl. XLIV, fig. 17.
Alaska (Sitka), on rocks and shells.

1904. S. EXIMIUS * sp. nov. (See p. 239.)
Pl. XXXIX, fig. 9 ; Pl. XLI, figs. 7, 18, 20 ; Pl. XLIII, figs. 6, 11, 17.
California (Pacific Grove), on worm tube (*Serpula*).

1904. S. INCONGRUUS * sp. nov. (See p. 241.)
Pl. XL, figs. 19, 20, 28.
Alaska (Prince William Sound), on worm tubes (*Serpula* and *Crucigera*).

1904. S. LINEATUS * sp. nov. (See p. 242.)
Pl. XXXIX, fig. 29.
Alaska (Sitka and Prince William Sound), on shells and worm tubes.

1904. S. SIMILIS * sp. nov. (See p. 242.)
Pl. XXIX, fig. 3, *c*; Pl. XXXIX, figs. 16, 31; Pl. XL, figs. 9, 17, 18; Pl. XLIII, figs. 27, 31.
Alaska (Prince William Sound), on worm tubes (*Crucigera*).

1904. S. RUGATUS * sp. nov. (See p. 243.)
Pl. XXIX, fig. 3, *b*; Pl. XXXV, fig. 14; Pl. XLIV, figs. 18, 19.
Alaska (Sitka), on rocks.

1904. S. COMPTUS * sp. nov. (See p. 244.)
California, on algæ.

1904. S. ASPERATUS * sp. nov. (See p. 245.)
Pl. XXVIII, fig. 10; Pl. XXX, fig. 4; Pl. XLI, figs. 4, 5, 6, 8, 10, 11, 19, 31, 32; Pl. XLIII, figs. 1, 2, 3, 7, 13, 26.
California (Pacific Grove), Alaska (Sitka and Prince William Sound), on shells and worm tubes (*Crucigera*).

1904. S. ABNORMIS * sp. nov. (See p. 245.)
Pl. XXXIX, fig. 35; Pl. XL, figs. 1, 2; Pl. XLIII, figs. 24, 28, 29.
Alaska (Sitka), on rocks.

1904. S. INVERSUS * sp. nov. (See p. 246.)
Australia (Port Phillip, Victoria), on bryozoa (*Menipea cirrata?*).

1904. S. TRIDENTATUS * sp. nov. (See p. 246.)
Australia (Port Phillip, Victoria), on bryozoa (*Menipea cirrata?*).

1904. S. TUBÆFORMIS * sp. nov. (See p. 251.)
Pl. XXXIX, figs. 30, 32; Pl. XLII, figs. 13, 14.
Long Island Sound, on Irish moss (*Chondrus*).

1904. S. EVOLUTUS * sp. nov. (See p. 251.)
Pl. XLII, figs. 20–22.
Grand Banks of Newfoundland, on shells (*Sipho*).

1904. S. FORMOSUS * sp. nov. (See p. 252.)
Pl. XXXIX, figs. 18, 19; Pl. XLI, fig. 22; Pl. XLIII, figs. 18, 23, 25, 30.
Gulf Stream and Bermuda, on gulf-weed (*Sargassum*), etc.

1904. S. MUTABILIS * sp. nov. (See p. 252.)
Bermuda, on shells.

BIBLIOGRAPHY.

Abildgaard, P. E.

1789 Beschreibung zween Arten des Steinbohrers. Schrift. Gesellsch. naturforsch. Freunde, Berlin, IX, Germany.

Adams, J.

1797 Descriptions of *Actinia crassicornis* and some British Shells. Trans. Linn. Soc., III, p. 252, London, England.

Agassiz, A.

1866–7 On the Young Stages of a few Annelids. Ann. Lyceum Nat. Hist., VIII, pp. 303–343, pls. 6–11, New York; Ann. and Mag. Nat. Hist. (3) XIX, p. 215, London.

1889 Three Cruises of the 'Blake.' Bull. Museum Comparative Zoology, Cambridge, Massachusetts, XIV–XV. (Worms, XV, p. 52, with woodcuts.)

Alder, H.

1866 Peculiarity in the structure of the shell of *Serpula triquetra*. Rep. Brit. Assoc. Adv. Science, p. 206, London, England.

Andrews, E. A.

1891 Annelida Polychæta of Beaufort, North Carolina. (Separate.) Proc. U. S. National Museum, XIV, p. 277, pls. xii–xviii, Washington, D. C.

On the Eyes of Polychæta. Zool. Anzeiger, XIV, p. 285, Leipzig, Germany.

Compound Eyes of Annelids. Journ. Morphol., V, p. 271, 2 plates, Boston, Massachusetts.

1892 On the Eyes of Polychætous Annelids. Journ. Morphol., VII, p. 169, pls. ix–xi, Boston, Massachusetts.

Audouin, J. V., et Milne Edwards, H.

1834 Recherches Hist. Nat. littoral de la France, Paris, France. II. Annélides. (290 pp., 18 plates.)

Baird, W.

1865 Description of several new species and varieties of Tubicolous Annelides = Tribe Limivora of Grube, in the British Museum. Journ. Linn. Soc. London, VIII, p. 10, pls. i–ii. On new Tubicolous Annelids in the British Museum. Journ. Linn. Soc. London, VIII, p. 157, pl. v.

1873 New Tubicolous Annelids in the British Museum. Journ. Linn. Soc. London, XI, p. 94.

Benedict, J. E.

1886 Description of ten species and one new genus of Annelids from the dredgings of the U. S. Fish Commission Steamer Albatross. (Separate.) Proc. U. S. Nat. Museum, IX, p. 547, pls. xx–xxv, Washington.

Berkeley, M. J.

1827–8 Descriptions of the animal inhabitants of two British Serpulæ. Zool. Journ., III, p. 230, and Supplement, pl. xviii, London, England.

1833 Observations upon the *Dentalium subulatum* of Deshayes. Zool. Journ., V, p. 424, pl. XIX, fig. 2, London.

1834 Observations on some British Serpulæ. Mag. Nat. Hist., VII, pp. 420–421, London.

Bidenkap, O.
1894 Undersogelser over Annulata Polychæta omkring Hardangerfjordens udlob sommeren 1893. Archiv for Math. og Natur., XVII, pp. 1–11, Christiania, Norway.

Blainville, H. M. D. de.
1815–28 Dictionaire des Sciences Naturelles, Paris, France.

Bosc, L. A. G.
1802 Histoire Naturelle des Vers, I, Paris.

Bourne, A. G.
1883 On *Haplobranchus*, a new genus of Capitobranchiate Annelids. Quart. Journ. Micro. Sci., XXIII, p. 168, pl. ix, London.

Brown, T.
1844 Illustrations Recent Conchology Great Britain and Ireland, 2d ed., p. 122, London.

Brulle, A.
Description de la *Sabella græca*. Exp. Mar., Entom.

Brunotte, C.
1888 Recherches anatomiques sur une espèce du genre *Branchiomma*. Travaux de la Station zoologique de Cette, Nancy. Comptes Rendus, CVI, p. 301, Paris. Journ. Roy. Micro. Soc., p. 219, London.

Bush, K. J.
1904 On *Spirorbis* from Japan, in Moore's Report on Sabellidæ and Serpulidæ. Proc. Acad. Nat. Sci., p. 175, text figures, Philadelphia, Pennsylvania.

Carlgren, O.
1900 Ueber die Einwirkung des constanten galvanischen Stromes auf niedere Organismen. Zweite Mittheilung: Versuche au verschiedenen Entwickelungsstadien einiger Evertebraten. Archiv für Phys., p. 465, Leipzig, Germany.

Carus, V.
1884 Prodromus Faunæ Mediterraneæ, Pars I. Stuttgart, Germany. (524 pp.)

Caullery, M., et Mesnil, F.
1896 Note sur deux Serpuliens nouveaux. Zool. Anz., XIX, pp. 482–486, with figures in text, Leipzig.
1897 Sur les *Spirorbis;* asymétrie de ces Annélides et enchainement phylogénique des espèces du genre. Comptes Rendus, CXXIV, pp. 48–51, Paris. Translated, Ann. Mag. Nat. Hist. (6), XIX, pp. 411–412, London. Études sur la morphologie comparée et la phylogénie des espèces chez les *Spirorbis*. Bull. sci. France et Belgique, XXX, pp. 185–233, pls. vii–x, et 4 figures dans le texte, Paris.

Chiaje, St. delle.
1825–28 Memorie sulla storia e notomia degli animali senza vertebre del regno di Napoli, II, pp. ii, 4, 185–444, pls. xiii–xxx, 1825; III, pp. ii, xx, 232, pls. xxxi–xlix, 1828, Naples, Italy.

Chigi, L.

1890 Organi escretori e Glandole tubipore delle Serpulacee, I. (103 pp., 15 plates.)

Claparède, E.

1863 Beobachtungen über Anatomie und Entwickelingsgeschichte wirbelloser Thiere.

1864 Glanures zootomiques parmi les Annélides de Port-Vendres. Mém. Soc. phys. Hist. nat., Genève, XVII, pp. 463–699, pls. i–viii.

1867–9 Les Annélides Chétopodes du golfe de Naples. Mém. Soc. phys. Hist. nat., Genève, XIX, XX, with supplement.

1873 Recherches sur la structure des Annélides sédentaires. Mém. Soc. phys. Hist. nat., Genève, XXII, pp. 1–199, pls. i–xv, und Metschnikoff, E.

1869 Beiträge zur Erkenntniss der Chætopoden. Zeitschr. wiss. Zool., XIX, p. 197, pl. xvi, Leipzig, Germany.

Conn, H. W.

1884 Note from the Chesapeake Zoological Laboratory. Development of *Serpula*. Zool. Anz., VII, p. 669, Leipzig.

Conte, A.

1899 See under Vaney.

Coupin, H.

1900 Les Animaux incrusteurs. Rev. Sci. (4), XIII, p. 684, Paris, France.

Cunningham, J. T.

1887 Some points in the Anatomy of Polychæta. Quart. Journ. Micro. Sci., XXVIII, p. 239, pls. xvii–xix, London, England.

1888 Polychæta Sedentaria of the Firth of Forth. Trans. Roy. Soc. Edinburgh, Scotland, XXXIII, PT. III, p. 635, pls. xxxvi–xlvii.

Cuvier, G.

1830–37 Le Règne Animal, 2d ed., 1830; 3d ed., 1857, Paris. Annélides by Milne Edwards.

1844 Guerin-Méneville, Iconographie du règne animal, 10e liv., Paris. (Annélides, 14 pp., 10 plates.)

Dalyell, J. G.

1853 The Powers of the Creator displayed in the Creation, etc., II, pp. 212–252, pls. 30–34, London.

Danielssen, D. C.

1859 Beretning om en zoologisk Reise i Sommeren 1858. Kongelige Norske Videnskabers selskabs Skrifter, IV, pp. 97–164, Trondhjem, Norway.

1861 Beretning om en zoologisk Reise foretagen i Sommeren 1859. Nyt Magazin for Naturvidenskeberne, XI, pp. 1–58, Christiania, Norway. (Annulata, p. 49.)

Daudin, F. M.

1800 Recueil de mémoires et de notes sur les espèces inédites ou peu connues de Mollusques, Vers et Zoophytes, Paris.

Nouveau genre de ver à tube calcaire, voisin des Serpules et des Dentales [*Vaginella depressa*]. Bull. Sci. Soc. Philom., Paris, II, p. 145.

Dawson, J. W.

1860 On the Tubicolous Marine Worms of the Gulf of St. Lawrence. Canadian Nat. and Geol., v, pp. 24–30, Montreal, Canada.

Donovan, E.

1801 The Natural History of British Shells.

Drasche, R.

1883 Ueber die Entwickelung von *Pomatoceros*. Zool. Anz., vi, p. 506, Leipzig, Germany.

1884–5 Beiträge zur Entwickelung der Polychæten. Wien. i. Entwickelung von *Pomatoceros triqueter* (10 pp., with 3 plates). ii. Entwickelung von *Sabellaria spinulosa*, *Hermione hystrix*, und einer Phyllodocide. (23 pp., with 5 plates.)

Edwards, H. Milne.

1830–41 Le Règne Animal (G. Cuvier). Annélides, vi.

1844 Observations sur le devéloppement des Annélides, faites sur les côtes de la Sicile. Comptes Rendus, xix, pp. 1409–1426, Paris, France.

Edwards, H. Milne, et Audouin, J. V.

1832–6 Classification des Annélides, et description de celles qui habitent les côtes de la France. Ann. Sci. nat., xxvii, pp. 337–347; xxviii, pp. 187–247; xxix, pp. 195–269, 388–412; xxx, pp. 411–425, Paris.

Edwards, J. B.

1859 On the Marine Animals of the Mersey shore. Rep. Proc. Literary and Philos. Soc. Liverpool, England, xiii, p. 229.

Ehlers, E.

1871 Ueber die auf der von Heuglin–Waldburg'schen Expedition nach Spitzbergen gesammelten Würmer. Sitz. phys. med. Soc. Erlangen, Germany, iii, pp. 77–86. Translated, Ann. Mag. Nat. Hist. (4), viii, pp. 53–61, London, England.

1875 Beiträge zur Kenntniss der Verticalverbreitung der Borstenwürmer im Meere. Zeitschr. wiss. Zool., xxv, pp. 1–102, pls. i–iv, Leipzig.

1878–9 Blake Annelids. Preliminary Report. Bull. Mus. Comp. Zool. Harvard, pp. 269–274, Cambridge, Massachusetts.

1887 Report on the Florida Annelids collected by the 'Blake.' Memoirs Mus. Comp. Zool., xv, Cambridge, Massachusetts. (335 pp., with 60 plates.)

1900 Magellanische Anneliden gesammelt während der schwedischen Expedition nach den Magellansländern. Nachr. k. Gesells. d. Wiss. Göttingen, Germany.

1901 Die Anneliden der Sammlung Plate. (Separate.) Zool. Jahrbücher, Suppl. v, Fauna Chilensis, ii, Heft 2, p. 251, Jena, Germany.
Die Polychæten des magellanischen und chilenischen Strandes. Berlin, Germany. (232 pp., with 25 plates.)

Ehrenberg, C. G

1836–7 Ueber *Amphicora sabella*. Mitth. Gesells. naturf. Freunde Berlin, p. 2. Comptes Rendus, iv, pp. 26–27 (figures), Paris.

Eichwald, E.

1830 Naturhistorische Skizze von Lithauen, Volhynien und Podolien, in geognostisch-mineralogischer, botanischer und zoologischer Hinsicht entworfen, p. 198.

1841 Fauna Caspio-Cauc., p. 229, t. 38, f. 29 *ab*.

Ellis, J.

1755 An Essay toward a Natural History of the Corallines and other Marine Productions of the like kind commonly found on the coasts of Great Britain and Ireland.

Fabricius, O.

1780 Fauna Groenlandica, Copenhagen, Denmark, and Leipzig, Germany.

Fauvel, P.

1895 Catalogue des Annélides polychètes de St.-Vaast-la-Hougue. Bull. Soc. Linn. Normandie (4), IX, pp. 121–146, Caen, France.

1900 Annélides polychètes recueillies à Cherbourg. Mém. Soc. Cherbourg, XXXI (1898–1900), p. 305, Paris, France.

Fewkes, J. W.

1883 On the Development of certain Worm Larvæ. Bull. Mus. Comp. Zool., XI, p. 167, with 8 plates, Cambridge, Massachusetts.

1885 On the larval form of *Spirorbis borealis*. Am. Naturalist, XIX, p. 247, pls. xi–xii, Philadelphia, Pennsylvania.

1889 New Invertebrata from the Coast of California. Bull. Essex Institute, XXI, Salem, Massachusetts.

Fischli, Hermann.

1900 Polychäten von Ternate. Abhand. heraus. Sencken. natur. Gesells., XXV, p. 91, pl. iv–viii, Frankfort, Germany.

Fleming, J.

1820 Edinburgh Encyclopædia, VII.

1825 On the British Testaceous Annelids. Edinburgh Philos. Journ., XII, p. 238, Scotland.

Fol, H.

1888 Sur la répartition du tissu musculaire strié chez divers Invertébres. Comptes Rendus, CVI, p. 1178, Paris, France.

Frey, H., und Leuckart, R.

1847 Beiträge zur Kenntniss der wirbelloser Thiere.

Gay, C.

1849 Annélides du Chili. Historia fisica y politica de Chile. Zoologie, III, p. 33, Paris.

Giard, A.

1890 Sur la parenté des Annélides et des Mollusques. Comptes Rendus, CX, p. 90, Paris, France.

1890 Le Laboratoire de Wimereux en 1889. Recherches fauniques. Bull. sci. France et Belgique, XXII, Paris.

1893 Sur un type nouveau et aberrant de la famille des Sabellides (*Caobangia filleti*). Comptes Rendus Mém. Soc. Biol. (9), V, p. 473, Paris.

Gibson, R. J. H.

1885–6 First report on the Fauna of Liverpool Bay: Vermes. Proc. Literary and Philos. Soc., Liverpool, England, XL.

1886 Note on some of the Polychæta collected by the L. M. B. C. District. Fauna of Liverpool Bay. Report I, p. 342, pls. vii–viii, Liverpool, England.

Gmélin.

1789 Systema Naturæ, XIII.

Gosse, P. H.

1855 Some new or little known Marine Animals. Ann. Nat. Hist. (2), XVI, pp. 33, 310, pl. iv, London, England.

1863 A *Sabella* building its tube. Intellectual Observer, II, p. 77, London.

Götte, A.

1881 Abhandlungen zur Entwickelungsgeschichte der Tiere. I. Untersuchungen zur Entwickelungsgeschichte der Würmer: *Spirorbis nautiloides*. Zool. Anz., IV, p. 189, Leipzig, Germany.

Gould, A.

1841 Report on the Invertebrata of Massachusetts, 1st ed., pp. 7, 343, pl. i, Boston, Massachusetts.

Gray.

1843 Dieffenbach New Zealand, p. 295.

Greeff, R.

1879 Ueber pelagische Anneliden von der Küste der canarischen Insels. Zeitschr. wiss. Zool., XXXII, p. 237, pls. xiii–xv, Leipzig, Germany.

Grube, A. E.

1838 Zur Anatomie und Physiologie der Kiemenswürmer, Königsberg, Germany. (77 pp., 2 plates.)

1840 Actinien, Echinodermen und Würmer der Adriatischen und Mittelmeers, p. 64, 1 plate. Königsberg.

1846–63 Beschreibungen neuer oder wenig bekannter Anneliden. Beiträge I–VI. Archiv Naturg., XII–XXIX, Berlin, Germany.

1851 Familien der Anneliden. (Separate.) Archiv Naturg., XVI, pp. 249–364, 1850, Berlin.

1861 Ein Ausflug nach Triest und den Quarnero, Berlin. Description of species, pp. 138–152, pls. iii–iv.

1862 Mittheilungen über die Serpulen, mit besonderer Berücksichtigung ihrer Deckel. Jahresber. Schl. Gesells. vaterländ. Cultur, 1861, pp. 53–69, Breslau, Germany.

1863 Die Eigenthümlichkeiten der Körperbaues, die Systematik und Verbreitung der Sabellen. Jahresber. Schl. Gesells. vaterländ. Cultur, 1862, pp. 44–46, Breslau.

1868 Beschreibungen einiger von Georg Ritter von Frauenfeld gesammelter Anneliden und Gephyreen des Rothen Meeres. (Separate.) Verhandl. zool.-bot. Vereins, XVIII (Abh.), p. 629, pls. vii–viii, Vienna Mittheilungen über St. Malô und Roscoff und die dortige Meeres besonders Annelidenfauna. (Separate.) Abhandl. Schl. Gesells. vaterländ. Cultur; Abth. Naturw. und Medecin (1869–1872), pp. 75–146, pls. i–ii, Breslau.

1868–69. Mittheilungen über St.-Vaast-la-Hougue und seine Meeres, besonders seine Annelidenfauna. Abhandl. Schl. Gesells. vaterländ. Cultur, 1868–9, pp. 91–128, pl. 1, Breslau.

1870 Bemerkungen über Anneliden des Pariser Museums. Arch. Naturgesch., xxxvi, p. 281, Berlin, Germany.
Neue Arten der Gattung *Sabella*. Jahresber. Schl. Gesells. vaterländ. Cultur, 1869, xlviii, p. 67, Breslau, Germany.

1871 Ueber die Gattung *Lycastis* und ein Paar neue Arten derselben, p. 19. Bericht Thätigkeit naturw. Section Schl. Gesells. im Jahre 1871, Breslau.

1874 Descriptione annulatorum novorum mare Ceylonicum habitantium ab Honoratissimo Holdsworth collectorum. (Separate.) Proc. Zool. Soc. London, p. 325.

1877 Anneliden-Ausbeute von S. M. S. Gazelle. (Separate.) Monatsber. Akad. Wiss. Berlin. Sitz. phys.-math. Klasse, pp. 509–554.

1878 Neue Anneliden aus Japan. Jahresber. Schl. Gesells. vaterländ. Cultur, 1877, p. 104, Breslau.

1878–9 Annulata Semperiana. Beiträge zur Kenntniss der Annelidenfauna der Philippinen nach den von Herrn Prof. Semper mitgebrachten Sammlungen. Mém. Acad. imp. Sci. St. Petersbourg (7), xxv, pp. ix–300, 15 plates, St. Petersburg, Russia, and Leipzig, Germany. Jahresber. Schl. Gesells. vaterländ. Cultur, 1879, lxii, p. 230, Breslau.

Guérin, M. F. E.

1829–43 Iconographie Règne Animal de G. Cuvier. Annelids, 1 (text), pp. 1–14; ii (plates), pls. 1–10, Paris.

Gunnerus.

1768 On nogle Norske Corallar. Norske Selsk. Skr., iv, Trondhjem, Norway.

Haddon, A. C.

1887 Preliminary Report on the Fauna of Dublin Bay. Proc. Roy. Irish Acad. (2), iv, p. 523, 1884–8, Dublin, Ireland.

Haddon, A. C., and Jacob, H. W.

1888 First Report on the Marine Fauna of the Southwest of Ireland. Proc. Roy. Irish Acad. (2), iv, p. 599, 1884–8, Dublin. (Vermes, pp. 621–623.)

Hansen, G. A.

1878 Oversigt over de norske *Serpula*-Arter. Nyt Mag. Naturv., Christiania.

1879–80 Annelider fra den norske Nordhavs-expedition i 1876, 1877, 1878. Nyt Mag. Naturv., xxiv, p. 1, pls. i–x, p. 268, pls. i–ii; xxv, p. 224, pls. i–v, Christiania, Norway. (Separate, 1882.)

1882 Recherches sur les Annélides recueillies par M. le Prof. E. van Beneden pendant son voyage au Brésil et à La Plata. Mém. Acad. roy. Sci. Lettres et Beaux-Arts, Belgique, xliv, Brussels, Belgium. (29 pp., 7 plates.)

Haswell, W. A.

1882 On some new Australian Tubicolous Annelids. Proc. Linn. Soc. New South Wales, vii, p. 633, pl. xii, Sydney, Australia.

1884 The Marine Annelids of the Order Serpula. Observations on their anatomy, etc. Proc. Linn. Soc. New South Wales, ix, p. 649, pls. xxxi–xxxv.

1888 Jottings from the Biological Laboratory of Sydney University. NO. 10. Embryology of *Vermilia cæspitosa* and *Eupomatus elegans*. Proc. Linn. Soc. New South Wales (2), II, Pt. 4, p. 1032.

Hatschek, B.

1885 Entwickelung der Trochophora von *Eupomatus uncinatus* (Phil.). Arbeiten aus dem zoologischen Institut der Universität Wien, VI, p. 121, 5 plates, Vienna, Austria.

Hornell, J.

1892 Report on the Polychætous Annelids of the L. M. B. C. District. Fauna of Liverpool Bay. Report III, p. 126, pls. xiii–xv, Liverpool, England.

Horst, R.

1895 Naamlijst der tot de nederlandische Fauna behoorende Annelida Polychæta. Tijdschrift der Nederlandsche Dierkundige Vereeniging, p. 15, Leiden, Holland.

Huxley, T. H.

1855 On a hermaphrodite and fissiparous species of Tubicolar Annelid (*Protula dysteri*). Edinburgh New Philos. Journ., N. S., I, p. 113, figs. 1–11.

Jacquet, M.

1885 Recherches sur le système vasculaire des Annélides. Mittheil. Zool. Station zu Neapel, VI, Naples, Italy.

Johnson, H. P.

1897 Preliminary Account of the Marine Annelids of the Pacific Coast, with Descriptions of New Species. (Separate). Proc. California Acad. Sci. (3), I, pp. 153–198, pls. v–x, San Francisco, California.

1901 Polychæta of the Puget Sound Region. Proc. Boston Soc. Nat. Hist., XXIX, pp. 381–437, 19 plates, Boston, Massachusetts.

Johnston, G.

1827–46 British Annelids. Zool. Journ., III, 1827, London; Mag. Nat. Hist., VII, VIII, 1834–1835, London; Mag. Zool. and Botany, II, 1838, Edinburgh; Ann. Nat. Hist., II, III, V, VI, XVI, 1839–1846, London.

1865 Cat. Non-Parasitical Worms Brit. Mus., London. (365 pp., 20 plates.)

Jourdan, E.

1887 Sur la structure des fibres musculaires de quelques Annélides polychétes. Comptes Rendus, CIV, p. 795, Paris.

Keferstein, W.

1862 Untersuchungen über niedere Seethiere. Zeits. wiss. Zool., XII, pp. 1–147, pls. i–xi, Leipzig.

Keswal.

1892 A Tubicolar Annelide. Jour. Bombay Nat. Hist. Soc., VII, p. 114, India.

Kölliker, A.

1858 Ueber Kopfkiemer mit Augen an den Kiemen. Zeits. wiss. Zool., IX, pp. 536–541, Leipzig.

Koren, J.

1857 Indberetning til collegium academicum om zoologist reise sommeren 1850. Nyt Mag. Naturv., Christiania, Norway.

Kröyer, H.

1856 Om Sabellerne. Danske Vidensk. Selsk. Forhandlinger, pp. 1–36, Copenhagen, Denmark.

Lacaze-Duthiers, H. de.

1872 A propos de la station des Chætoptères et des Myxicoles sur les plages Roscoff, etc. Archiv Zool. expér. gén., I, p. xvii, Paris.

Lamarck, J. B. P. A. de.

1818 Histoire naturelle des Animaux sans vertèbres, 1 ed., v, 1818; 2d ed., v, 1838. Annélides, par Milne Edwards.

Lang, A.

1884 Die Polycladen. Fauna und Flora des Golfes von Neapel. XI. Monographie.

Langerhans, P.

1879–84 Die Wurmfauna von Madeira, Pts. I–IV. Zeits. wiss. Zool., XXXII, p. 513, pls. xxxi–xxxiii; XXXIII, p. 271, pls. xiv–xvii; XXXIV, p. 87, pls. iv–vi; XL, p. 247, pls. xv–xvii, Leipzig.

1881 Ueber einige canarische Annelides. Nova Acta phys.-med. Acad. Cæs. Leopoldino-Carolinæ Nat. Cur., XLII, p. 43, pls. iv–v, Halle, Germany.

Leach, W. E.

1824 Annulosa. Encyclopædia Britannica, Supplement.

Leidy, J.

1855 Contributions towards a knowledge of the Marine Invertebrate Fauna of the Coasts of Rhode Island and New Jersey. Journ. Acad. Nat. Sci. Philadelphia (2), III, pp. 144–148, 2 plates.

1858–9 *Manayunkia speciosa*. Proc. Acad. Nat. Sci. Philadelphia, 1858, p. 90; 1859, p. 2.

1883 *Manayunkia speciosa*. (Separate.) Proc. Acad. Nat. Sci. Philadelphia, p. 204, pl. ix.

Lesson, R. P.

1830 Centurie Zoologique, p. 147, t. 51, f. 2.

Leuckart, B.

1849 Zur Kenntniss der Fauna von Island. Archiv Naturg., XV, pp. 155, 189, pl. iii, Berlin, Germany.

1855 Ueberdie Jugend zustände einiger Anneliden. Archiv Naturg., XXI, p. 63, pl. ii, Berlin; Ann. Nat. Hist., XVI, p. 259, London.

Levinsen, G. M. R.

1878 Om to nye Stægter af arctiska chætopode Annelider. (Separate.) Vidensk. Medd. Naturhist. Forening, Kjøbenhavn, pp. 1–10, pl. i, 1879–1880, Copenhagen, Denmark.

1883 Systematisk-geografisk Oversigt over de nordiske Annulata, Gephyrea, Chætognathi og Balanoglossi. Vidensk Medd. Naturh., 1882–3, pp. 1–94, pl. i; pp. 95–354, pls. ii–iii, Copenhagen.

1886 Kara-Havets Ledorme (Annulata). (Separate.) Dijmphna-Togtets zoologisk-botaniske Udbytte, pp. 289–303, pl. xxv, Copenhagen.

Leydig, F.

1851 Anatomische Bemerkungen über Carinaria, Firola und Amphicora. Zeits. wiss. Zool., III, p. 328, pl. ix, Leipzig.

Linné, C. von.
1767 Systema Naturæ, XII.

Lo Bianco, S.
1893 Gli anellidi tubicoli trovati nel golfo di Napoli. Atti R. Accad. Sci. Napoli (2), V, p. 75, with 3 plates, Naples, Italy.

Lord, J. K.
1866 The Naturalist in Vancouver Island and British Columbia. 2 vols., London.

Löwe, L.
1879 Studien in der Anatomie der Athmungsorgane. 1. Zur Anatomie der Serpulakieme. Zeitschr. wiss. Zool., XXXII, p. 158, pl. ix, Leipzig.

Lütken, C.
1875 A Revised Catalogue of the Annelida and other, not Entozoic, Worms of Greenland, pp. 167–178, Copenhagen, Denmark.

Macé, E.
1882 De la structure du tubes des Sabelles. Archiv. Zool. expér. gén. (1), X (notes), p. ix, Paris.

McIntosh, W. C.
1869 On the boring of certain Annelids. Ann. Mag. Nat. Hist. (4), II, p. 276, pls. xviii–xx, London.
1873 (In Whiteaves.) Report of the Second (1872) Deep-sea Dredging Expedition to the Gulf of St. Lawrence, Montreal, Canada. Rept. Minister Marines and Fisheries Canada.
1874 On the Annelida of the Gulf of St. Lawrence, Canada. Ann. Mag. Nat. Hist. (4), XIII, pp. 261–270, pls. ix–x, London.
1876 Descriptions of some new species of Annelida from the Kerguelen Islands. Ann. Mag. Nat. Hist. (4), XVII, p. 318, London.
(In Jeffreys and Carpenter.) The Valorous Expedition. Preliminary Report of the Biological Results of a Cruise in H. M. S. 'Valorous' to Davis Strait in 1875. Proc. Royal Soc. London, XXV, Annelida, pp. 215–222.
1876–7 On British Annelida, PT. I. Trans. Zool. Soc. London, IX, PT. VII, pp. 371–394, pls. lxvii–lxx.
On the Annelida of the 'Porcupine' Expeditions of 1869 and 1870. Trans. Zool. Soc. London, IX, PT. VII, pp. 395–416, pls. lxxi–lxxiii.
1878 On the Annelida obtained during the Cruise of H. M. S. 'Valorous' to Davis Strait in 1875. Trans. Linn. Soc. London (2), Zool., I, p. 499, pl. lxv.
1879 On the Annelids of the British North-polar Expedition. Journ. Linn. Soc. London, XIV, p. 126, text figures.
1885 Report on the Annelida Polychæta H. M. S. Challenger, XII, London. (554 pp., 84 plates.)
1901 (In Whiteaves) Catalogue of the Marine Invertebrata of Eastern Canada, pp. 68–88, Ottawa, Canada.

Malaquin, A.
1895 La formation du schizozoite dans la scissiparite chez les Filigranes et les Salmacynes. Comptes Rendus, CXXI, p. 953, Paris.

Malmgren, A. J.

1865 Nordiska Hafs-Annulater. Öfvers. K. Vet.-Akad. Förhandlingar, pp. 355–410, taf. xviii–xxix, Stockholm, Sweden.

1867 Annulata Polychæta. Öfvers. Vet.-Akad. Förh., pp. 1–127, taf. i–xiv, Stockholm, Sweden. (Separate, Leipzig, Germany, 1869.)

Marenzeller, E. von.

1876 Zur Kenntniss der adriatischen Anneliden, 1875. Sitzungs. math.-phys. Classe Kais. Akad. Wiss., LXXII, pp. 129–171, Vienna, Austria.

1878 Die Cœlenteraten, Echinodermen und Würmer der Nordpol-Expedition, pp. 390–398, pl. iv, fig. 2. Denks. Kais. Akad. Wiss. XXXV, p. 357, Vienna.

1879 Südjapanische Anneliden. Denks. Kais. Akad. Wiss., XLI, pp. 109–154; Wien Anzeiger, XVI, pp. 152–153.

1884 Südjapanische Anneliden. II. Denks. Kais. Akad. Wiss., XLIX, pp. 197–224, tafs. i–iv.

1886 Poriferen, Anthozoen, Ctenophoren und Würmer von Jan Mayen, etc. (16 pp., 1 plate.)

1889 Spitzbergische Anneliden. Archiv Naturg., I, pp. 127–132, Berlin.

1890 Annulaten des Beringsmeeres. Ann. k. kais. Hofsmuseums, V, pp. 1–8, taf. I, Vienna, Austria.

1892 Die Polychæten der Bremer Expedition nach Ostspitzbergen in Jahre 1889. Zool. Jahrb. Abth. Syst. Geog. und Biol. Thiere, VI, p. 397, pl. xix, Jena, Germany.

1893 Polychæten des Grundes, gesammelt 1890, 1891 und 1892. Zoologische Ergebnisse II. Denks. Kais. Akad. Wiss., LX, pp. 25–48, pls. i–iv, Vienna.

Marion, A. F.

1872 Sur les organes reproductives de l'*Oria Armandi* Clap. Comptes Rendus, LXXIV, p. 1254, Paris.

1874 Sur les Annélides du golfe de Marseille. Comptes Rendus, LXXIX, p. 398, Paris; Ann. Mag. Nat. Hist. (4), XIV, p. 313, London; Revue zool. (3), II, p. iv, Paris.

1875–6 Sur les Annélides de Marseille. Revue Sci. nat., IV, p. 301, pl. vi, Paris.

1879 Draguages au large de Marseille. (Separate.) Ann. Sci. nat. (6), VIII, pp. 1–48, pls. 15–17, Paris.

Marion, A. F., et Bobretzky, N.

1875 Annélides du golfe de Marseille. Ann. Sci. nat. (6), II, pp. 1–106, pls. i–xii, Paris.

Mesnil, F., et Caullery, M.

1896 Note sur deux Serpuliens nouveaux. Zool. Anz., XIX, pp. 182–186, with figures in text, Leipzig.

1897 Sur les Spirorbis; asmyétrie de ces Annélides et enchainement phylogénique des espèces du genre. Comptes Rendus, CXXIV, pp. 48–51, Paris. Translated, Ann. Mag. Nat. Hist. (6), XIX, pp. 411–412, London. Etudes sur la morphologie comparée et la phylogenie des espèces chez les *Spirorbis*. Bull. sci. France et Belgique, XXX, pp. 185–233, pls. VII–X, et 4 figures dans le texte, Paris.

Metzger, A.

1873 (Expedition zur Untersuchung der Ostsee, 1871. Bericht.) Physikalische und faunistische Untersuchungen in der Nordsee während des Sommers, 1871. Deutschen Meere Jahresber., I, pp. 165–176, Berlin.

Meyer, E.

1887–1901 Studien der Körperbau der Anneliden. Mitth. Zool. Stat. Neapel, VII, p. 592, pls. xxii–xxvii; VIII, p. 462; XIV, p. 247, pls. xii–xvii; see also, Journ. Roy. Micro. Soc., 1888, p. 222, and 1889, p. 385, London.

Michaelsen, W.

1892 Polychæten von Ceylon. (Separate.) Jahresber. Hamburg wiss. Anstalten, IX, 2, pp. 1–28, with plate.

1897 Polychætenfauna der deutschen Meere. Hamburg. (216 pp., 1 plate.)

1898 Grönlandische Anneliden. Bibliotheca Zoologica, XX, 4; Zool. Ergeb. Grönl. Expd. nach Dr. Vanhöffen's Sammalungen, IX, pp. 120–130, 3 figures, Berlin.

Möbius, K.

1874 Mollusken, Würmer, Echinodermen und Cœlenteraten. (Separate.) Zweite deutsche Nordpolarfart, II, p. 246, pl. i. Translated, Ann. Mag. Nat. Hist. (4), XIII, p. 196, Annelides, pl. xi, London.

1875 Expedition zur Untersuchung der Nordsee 1872–3. Zoologische Ergebnisse v. Vermes. Deutschen Meere Jahresber., II und III, pp. 153–171, pl. iii, Berlin; Abstract, Zeitschr. Gesell. Naturw. XII, pp. 173–181, Berlin.

Montagu, G.

1803 Testacea Britannica.

1804 New and rare Animals found on the coast of Devonshire. Trans. Linn. Soc. London, VII, pp. 80–84, pl. vii.

1808 New and rare Animals found on the south coast of Devonshire. Trans. Linn. Soc. London, IX, pp. 108–111, pls. vi–viii.

1815 Descriptions of several new or rare Animals, principally marine, found on the south coast of Devonshire. Trans. Linn. Soc. London, XI, pp. 18–21, pls. iii–v.

Moore, J. P.

1902 Descriptions of some New Polynoidæ, with a List of other Polychæta from North Greenland Waters. Proc. Acad. Nat. Sci. Philadelphia, LIV, p. 258, pls. xiii–xiv, Philadelphia, Pennsylvania.

1904 Sabellidæ and Serpulidæ from Japan, with an appendix on *Spirorbis*, by Katharine J. Bush. Proc. Acad. Nat. Sci. Philadelphia, LVI, p. 157. pls. xi and xii, with text figures.

Mörch, A. L.

1863 Revisio critica Serpulidarum et Bidrag til Roromenes Naturhistorie. Naturhist. Tidsskrift, I, pp. 347–470, tab. xi, Copenhagen, Denmark.

Müller, O. F.

1771 Die nierenformige Amphitrite von Würmern des süssen und salzigen Wassers. Copenhagen.

1787 Zoologia Danica, III.

Oken, L.

1815 Manuel de Zoologie.

Örley, L.

1884 Die Kiemen der Serpulaceen. Mitth. Zool. Stat. Neapel, v, p. 197, pls. xii–xiii. Ueber die Athmung der Serpulaceen in Allgemeinen mit besonderer Rücksicht auf den Werth ihrer Hautpigment. Természetrajzi Füzetek, viii, pp. 199–207, Budapest, Austria-Hungary.

Örsted, A. S.

1844–5 Fortegnelse over Dyr, samlede i Christianiafjord ved Drobat, fra 21–24 Juli, 1844. Naturhist. Tidsskrift., i, Vermes, pp. 403–419, tab. v, Copenhagen, Denmark.

Ortman, A. E.

1900 Synopsis of the collections of Invertebrate fossils made by the Princeton Expedition to Southern Patagonia. Amer. Journ. Sci. (4), x, p. 368, New Haven, Connecticut.

Pagenstecher, H. A.

1863 Untersuchungen über niedere Seethiere aus Cette. Entwickelung und Brutpflege von *Spirorbis spirillum*. Zeitschr. wiss. Zool., xii, p. 486, pls. xxxiii–xxxix, Leipzig, Germany.

Pallas, P. S.

1784–8 Marina varie nova et rariora. Nova Acta Acad. Sci. Petropolitanæ, ii, p. 236, pl. 5, fig. 21.

Pennant, T.

1777 British Zoology, iv.

Peyssonel, J. A.

1759 New Observations upon the Worm that forms Sponges. Philos. Trans. Roy. Soc. London, l, Pt. ii, p. 590.

Philippi, A.

1844 On the genus *Serpula*, enumeration of Mediterranean species. Ann. Mag. Nat. Hist., xiv, p. 153, pl. iii, London; Archiv Naturg., xix, p. 186, pl. vi, Berlin.

Pruvot, G., et Racovitza, E. G.

1895 Matériaux pour la faune des Annélides de Banyuls. (Separate.) Archiv Zool. expér. gén. (3), iii, p. 339, figures, et pls. xv–xx, Paris.

Quatrefages, A. de.

1848 Sur une Annélide lithophage du genre *Sabella*. Proces-Verbaux, Séances Soc. Philom. Paris, pp. 42–43.

1850 Mémoire sur la cavité du corps des Invertébrés. Ann. Sci. nat. (3), xiv, p. 329, Paris.

1865 Histoire Naturelle des Annéles, ii, pp. 398–562, 665–670, pls. 9, 10, 12, 14–16. Paris.

Rathke, H.

1836 Zur Fauna der Krym. Mem. Acad. imp. Sci. St. Petersbourg, iii, St. Petersburg, Russia. (Würmer, pp. 407–429.)

Reinhardt, F.

1857 Naturhistoriste Bidrag til en Beskrivelse af Grønland. Annelider, pp. 39–46, Copenhagen.

Risso, A.

1826 Histoire naturelle des principales productions de l'Europe méridionale, iv, pp. vii–439, 12 plates, Paris.

Roule, L.

1885 Esquisse du développement de la *Dasychone lucullana*. Rev. Sci. nat. (3), IV, p. 463, Montpellier, France.

1896 Résultats scientifiques de la Campagne du 'Caudan' dans le golfe de Gascogne. Annélides. Annales de l'Université de Lyon, XXVI, pp. 439–471, pls. xix–xxv, Lyon; Comptes Rendus, CXXII, pp. 1009–1012, Paris.

1898 Notice préliminaire sur les espèces d'annélides recueilles dans les explorations sous-marines du "Travailleur" et du "Talisman." Bull. Mus. Paris, pp. 190–195; Comptes Rendus, CXXVI, pp. 1166–1168.

Sabatier, A.

1882 De la spermatogenèse chez les Annélides. Rev. Sci. nat. (3), I, p. 249, pls. vii–viii, Montpellier.

Saint-Joseph, Baron de.

1885 Sur les Annélides polychètes des côtes de Dinard. Comptes Rendus, CI, p. 1509, Paris.

1886–8 Annélides polychètes des côtes di Dinard, PTS. I, II. Ann. Sci. nat. (7), I, p. 127, pls. vii–xii; V, p. 141, pls. vi–xiii, Paris.

1892 Sur la croissance asymétrique chez les Annélides polychètes. Comptes Rendus, CXV, p. 887, Paris.

1894 Annélides polychètes des côtes de Dinard. Ann. Sci. nat. (7), XVIII, pp. 1–395, pls. i–xiii, Paris.

1898 Annélides polychètes des côtes de la France (Manche et Océan). Ann. Sci. nat. (8), V, VI, pp. 209–451, pls. xiii–xxiii, Paris.

Saint-Loup, R.

1894 Histoire naturelle de la France (Vers), Paris. (248 pp., 203 figures.)

Salensky, W.

1882, 3, 5, 7 Études sur le développement des Annélides. Archives de Biol ogie, III, p. 345, pls. xiv–xv, p. 561, pls. xxiii–xxv; IV, p. 143, pls. iv–ix-VI, p. 1, pls. i–v, p. 589, pl. xxiv, Paris. Abstract, Journ. Roy. Micro.; Soc. London (2), III, PT. 6, pp. 837–839. See also Biologisches Centralblatt, II, p. 198, Leipzig.

1888 Development of Annelids. Journ. Roy. Micro. Soc. London, p. 218.

Sars, M.

1835 Beskrivelser og Jagttagelser over nogle maerkelige eller nye i Havet ved den Bergenske Kyst levende Dyr of Polypernes, Acelephernes, Radiathernes, Annelidernes og Molluskernes Classes, etc. (+ 15 plates).

1851 Beretning om en i sommeren 1849 foretagen zoologisk reise i Lofoten oz Finmarken. Nyt Mag. Naturv., VI, pp. 121–211, Christiania, Norway. (Anneliden, p. 196.)

1853 Bemaerkninger om det Adriatiske Havs Fauna sammenlignet med Nordhavets. Nyt Mag. Naturv., VII, pp. 367–397, Christiania.

1861 Om de ved Norges kysten forekommende arter af den Linnéiska Annelideslaegt *Sabella*. Forh. Vidensk.-Selsk. Christiania, p. 116.

1863 Geologiske og zoologiske iagttagelser, anstillede paa en reise i en deel af Throndhjems Stift i sommeren 1862. Nyt Mag. Naturv., XII, p. 291, Christiania.

1864 Fortsatte bidrag til Kundskaben om Norges Annelider. Forh. Vidensk.-Selsk. Christiania.

1872 Diagnoser af nye Annelida fra Christianiafjorden. Forh. Viden.-Sel. Christiania, 1871, p. 417.

Savigny, J. C.

1809 Système des Annélides. Description de L'Egypte, text Histoire Naturelle, I, pt. 3, pp. 1–128; planches II′, pls. 1–5, Paris.

1826 Système des Annélides, ed. 2, XXI.

1832 System der Anneliden. Translated, Oken's Isis, col. 937–966.

Schenk, S. L.

1875 Entwickelungsvorgänge in Eichen von *Serpula* nach der künstlichen Befruchtung. Sitzung. Acad. Wien, LXX, pp. 387–400, 1 plate, Vienna.

Schimkerwitsch, W.

1894 Ueber die excretorische Thätigkeit des Mitteldarmes der Würmer. Biol. Centralbl., XIV, pp. 838–841, Leipzig.

Schively, M. A.

1897 Structure and development of *Spirorbis borealis*. Proc. Acad. Sci. Philadelphia, pp. 153–160, pls. i, ii, Philadelphia, Pennsylvania.

Schmarda, L. K.

1861 Turbellarien, Rotatorien und Anneliden, II, pp. 26–37, pls. xxi–xxiii, Leipzig.

Schmidt, O.

1848 Beiträge zur Naturgeschichte der Würmer gesammelt auf einer Reise nach der Färör in 1848, Jena, Germany.

Schubert, G. H.

1869 Atlas of the Natural History of the Animal Kingdom. Boston, Massachusetts.

Serres, M. de.

1855 Note sur un nouveau genre d'Annélide tubicole perforant. Ann. Sci. nat. (4), IV, p. 238, pl. 8c′, Paris.

Shaw, G.

1799 Descriptions of the *Mus bursarius* and *Tubularia magnifica*. Trans. Linn. Soc. London, V, p. 228, pl. ix.

Simonelli, V.

1887 Sulla strutture microscopica della *Serpula spirulæa*. Atti. Soc. Toscana Sci. nat. Pisa, V, p. 293, Italy.

Smith, S. I., and Harger, O.

1874 Report on the Dredgings of the region of George's Bank in 1872. (Separate.) Annelida, by A. E. Verrill. Trans. Connecticut Acad. Arts Sci., III, pp. 1–57, pls. 1–8, New Haven, Connecticut.

Soulier, A.

1888 Sur la formation du tube chez quelques Annélides tubicoles. Comptes Rendus, CVI, p. 505, Paris.

1889 Sur la structure de l'épiderme chez les Serpuliens. Comptes Rendus, CVIII, p. 460, Paris; Journ. Roy. Micro. Soc., p. 515, London.

1891 Études sur quelques points de l'anatomie des Annélides tubicoles de la region de Cette. Travaux l'Institut Zool. de Montpellier et la Cette, II. (310 pp., 10 plates.)

1899 Sur l'embryogénie de *Protula meikaci*. Comptes Rendus, CXXVIII, p. 1591, Paris.

Steenstrup, J.

1856 Notice om Hav-Ormen *Sabella marsupialia* Gud. Danske Sel. Forh., p. 37, Copenhagen.

Stimpson, W.

1853 Synopsis of the Marine Invertebrata of Grand Manan. Smithsonian Contributions to Knowledge, VI, pp. 29–36, Washington, District of Columbia.

1863 Annelida. A list of Animals dredged near Caribou Island, Southern Labrador, July–August, 1860. By A. S. Packard, Jr. (Separate.) Canadian Nat. Geol., VII, pp. 401–429, 2 plates, Montreal, Canada.

Synopsis of the Marine Invertebrata collected by the late Arctic Expedition under Dr. I. I. Hayes. Proc. Acad. Sci. Philadelphia, XV, pp. 138–142, Philadelphia, Pennsylvania.

Storm, V.

1878–81 Bidrag til kundskat om Throndhjemafjordens Fauna: Annelider. Norske Selsk. Skr., Throndhjem, Norway.

Studnička, F. K.

1900 Ueber Flimmer und Cuticularzellen mit besonderer Berücksichtigung der Centrosomenfrage. Sitz. Böhmischen Gesell. Wiss., or Vestník Královské České Společ nosti Nauk., 1899, No. XXXV, Prague, Bohemia. (22 pages, 1 taf. and figures.)

Tate, R.

1900 On the Occurrence of Marine Fossiliferous Rocks at Kerguelen Island. Trans. Roy. Soc. South Australia, XXIV, p. 104, pls. 2, 3, Adelaide.

Tauber, P.

1879 Annulata Danica, Copenhagen, Denmark.

Templeton.

1835 Proc. Zool. Soc. London, p. 112.

1841 Zool. Trans., II, p. 28, pl. V, figs. 15–18, London.

Théel, H. J.

1879 Annélides polychètes des Mers de la Nouvelle-Zemble. (Separate.) Svenska Vetensk. Akad. Handlingar, XVI, 1878, Stockholm, Sweden.

Treadwell, A. L.

1891 Preliminary note on the Anatomy and Histology of *Serpula dianthus* (Verrill). Zool. Anz., XIV, p. 276 (figures), Leipzig.

1901 The Polychætous Annelids of Porto Rico. (Separate.) Bull. United States Fish Commission, II, p. 181 (text figures), 1900, Washington, D.C.

Vaney, C., and Conte, A.

1899 Recherches expérimentales sur la régénération chez *Spirographis spallanzanii*. Comptes Rendus Soc. Biol., neuvième séries, p. 973, Paris.

Vanhöffen, E.

1897 Die Fauna und Flora Grönlands. Grönl. Exped. Gesell. Erdkunde, Berlin, 1891–3, II, PT. I.

Verrill, A. E.

1871 Marine Fauna of Eastport, Maine. Bull. Essex Inst., III, pp. 2–6, Salem, Massachusetts.

1873–4 Report upon the Invertebrate Animals of Vineyard Sound and the Adjacent Waters, with an account of the Physical Characters of the Region. U. S. Comm. Fish and Fisheries, PT. I. Report on Condition Sea Fisheries of South Coast of England in 1871–2, by Spencer F. Baird, Commissioner. Washington, D. C. Author's edition, 1874.

Brief Contributions to Zoology from the Museum of Yale College. NOS. XXV–XXIX. Results of recent Dredging Expeditions on the Coast of New England. NOS. 3–7. American Journ. Sci. and Arts (3), VI–VII, 5 plates. New Haven, Connecticut.

1874 Explorations of Casco Bay by the U. S. Fish Commission in 1873. Proc. American Assoc. Adv. Sci., pp. 340–395, Salem.

Notice of some Dredgings made near Salem by Dr. A. S. Packard, Jr., and C. Cooke, in 1873. Rept. Peabody Acad. Sci., VI, Salem.

1875 Brief Contributions to Zoology from the Museum of Yale College. NO. XXXII. Results of Dredging Expeditions off the New England Coast, in 1874. American Journ Sci. and Arts (3), IX, pp. 411–415, New Haven.

Brief Contributions to Zoology from the Museum of Yale College. NO. XXXIII. Results of Dredging Expeditions off the New England Coast. American Journ. Sci. and Arts (3), X, pp. 36–43, 196–202, pls. iii–iv, New Haven.

1876 Natural History of Kerguelen Island. Annelids and Echinoderms. Bull. U. S. Nat. Museum, NO. 3, p. 64, Washington, D. C.

1879 (In Kumlin.) Contributions to Natural History of Arctic America, made in connection with the Howgate Polar Expedition, 1877–8, Annelida. Bull. U. S. Nat. Museum, NO. 15, pp. 141–143. Washington.

Preliminary Check-list of the Marine Invertebrata of the Atlantic Coast from Cape Cod to the Gulf of St. Lawrence. Author's edition. Annelida, pp. 7–11, 32.

Notice of Recent Additions to the Marine Invertebrata of the Northeastern Coast of America, with Descriptions of new Genera and Species, and Critical Remarks on others. PT. I, Annelida, Gephyræa, Nemertina, etc. (Separate.) Proc. U. S. Nat. Museum, II, p. 185, Washington.

1881 New England Annelida. (Separate.) Trans. Conn. Acad. Sci., IV, p. 286, pls. iii–xiii, New Haven, Connecticut.

1884 Notice of the remarkable Marine Fauna occupying the outer banks of the Southern Coast of New England. Report U. S. Fish Comm., PT. X, for 1882, p. 664, Washington.

1885 Results of the Explorations made by the Steamer Albatross, off the Northern Coast of the United States in 1883. Annelida, p. 22, pls. xxxix, xliv. (Separate.) Report U. S. Fish Comm. for 1883, p. 503, Washington.

Viallanes, H.

1885 Sur la structure du squelette branchial de la Sabelle. Ann. Sci. nat. (6), XX, NO. 2, pp. 1–20, pl. 1; Mitth. Zool. Stat. Neapel, V, Naples, Italy.

1886 Sur le tissu cartilagineux de la Sabelle. Bull. Soc. Philom. Paris (7), X, p. 6.

Viguier, C.

1885 Sur les Annélides pélagiques de la Baie d'Alger. Comptus Rendus, CI, p. 578, Paris; Ann. Mag. Nat. Hist. (5), XVI, p. 395, London.

1886 Études sur les Animaux inférieurs de la Baie d'Alger. XX, Recherches sur les Annélides pélagiques. Archiv. Zool. expér. gén. (2), IV, pp. 347–442, pls. xxi–xxvii, Paris.

Watson, A. T.

1891–2 The protective device of an Annelid. Nature, XLIV, p. 507, 3 figures; XLVI, p. 7, London.

Webster, H. E.

1878 Annelida Chætopoda of the Virginian Coast, pp. 1–72, pls. i–xi. (Separate.) Trans. Albany Institute, IX, pp. 202–272, pls. i–xi, 1879.

1884 Annelida from Bermuda. (Separate.) Bull. U. S. Nat. Museum, NO. 25, p. 307, pls. vii–xii, Washington.

Webster, H. E., and Benedict, J. E.

1884 The Annelida Chætopoda from Provincetown and Wellfleet, Mass. Rept. U. S. Fish Comm. for 1881, p. 699, pls. i–viii, Washington.

1887 The Annelida Chætopoda from Eastport, Maine. Rep. U. S. Fish Comm. for 1885, p. 707, pls. i-viii, Washington.

Whiteaves, J. F.

1784 Report on Deep-Sea Dredging Operations in the Gulf of St. Lawrence, 1873, pp. 1–29. Montreal, Canada.

1880 Marine Invertebrata from Queen Charlotte Islands. (Separate.) Rep. Geol. Survey of Canada, 1878–9, pp. 1–16, Ottawa, Canada.

1901 Catalogue of the Marine Invertebrata of Eastern Canada, pp. 68–88. Ottawa.

Willemoes-Suhm, R. von.

1871 Biologische Beobachtungen über niedere Meeresthiere. Zeitschr. wiss. Zool., XXI, p. 387, pls. 31–33, Leipzig.
Development of *Spirorbis nautiloides* Lam. Ann. Mag. Nat. Hist. (4), VIII, p. 139, London.

1873 Ueber die Anneliden an den Küster der Faeroën. Zeitschr. wiss. Zool., XXIII, p. 346, pl. xviii, Leipzig.

Williams, T.

1851 Report on the British Annelids. Rep. Brit. Assoc. Adv. Sci., 21st meeting, p. 159, London.

Wirén, A.

1883 Chætopoder fian Sibiriska Ishavet och Behringshaf imsamlade under Vega-Expd., 1878-9. Vega Exped. Vetensk. Iakttagelser, II, pp. 381–428, pls. xxvii–xxxii, Stockholm, Sweden.

Wollemann, A.

1899 Die Serpula-Arten des Neocoms der Umgegend von Braunschweig. Jahresber. Vereins Naturw. zu Braunschweig, xi, p. 264, Brunswick, Germany.

ADDENDA.

The following notes, which with a few exceptions relate to forms previously mentioned, were made after the foregoing pages were set up, therefore too late to have them inserted in their proper places.

Genus **Metalaonome** nov. (See pp. 178 and 192.)

Branchial lobes elongated ventrally and spirally coiled only in retraction. Interbranchial membrane inconspicuous or wanting. Collar four-lobed, with ends widely separated on the back. Superior setæ and inferior collar setæ regularly tapered blades; inferior setæ back of collar, short oblanceolate. Avicular uncini only in all the tori of the body.

Lo Bianco (1893) described the species *Bispira mariæ* as having the elongated branchial lobes forming spirals of two or three turns, but in the figure he has represented them as simple, similar to those of *Sabella*, so that probably, like species of that genus, this one has them spiral only in retraction. The branchiæ, numbering between 80 and 90, are very long (about one half as long as body) and slender, with seven series of dark color spots forming bands.

The body is short and stout, of about 80 segments, of which 8 belong to the thorax.

The collar is four-lobed, open on back with widely separated ends. Setæ on the collar and superior setæ on the other thoracic segments very narrow, regularly tapered blades; inferior setæ back of collar, short and broad oblanceolate. Avicular uncini only in all the tori of the body.

Genera **Schizocraspedon** and **Glossopsis** nov. (See pp. 179 and 225.)

Grube (1878) placed his two new species *H. furcifera* and *H. minax* in the genus *Hydroides*, with which they have strong affinities, but the very remarkable development of the opercula, described on p. 225, would at once distinguish them from typical species of that genus; hence they have been respectively referred to the two new genera *Schizocraspedon* and *Glossopsis*.

Genus **Protoplacostegus** nov. (See pp. 179 and 226.)

McIntosh (1885) described and figured his species *Placostegus mörchii* as having a primary, somewhat cup-shaped operculum with horny plate on the end of one branchia and an undeveloped secondary one on the end of another branchia. The setæ short and broad at base with tapered blades (no collar setæ were found). Uncini with few (6

or 7) serrations, the lowest large and fang-like. As all of these characters differ greatly from those of *Placostegus tridentatus*, the type of the genus *Placostegus* (p. 221), the new genus *Protoplacostegus* is therefore proposed for McIntosh's species.

Genus **Spirorbis** Daudin. (See p. 247.)

On several specimens of *Margaritifera*, recently received from Beirut, Syria, are numerous tubes of three species of *Spirorbis*. One sinistral form is moderately large, regularly coiled, the surface more or less roughened by irregular concentric growth lines but with no distinct sculpture. The animals examined have a calcareous plate in the operculum, shallow, oblique, cup-shaped with broad, short base, with a conspicuous spine at the back, not differing from that figured by Marion and Bobretzky (1875) for *Spirorbis cornuarietis* of Philippi. The collar setæ have coarsely serrate tapered blades with coarse fin-like bases. On comparing this with the figure given by Philippi (1844) there was found a decided difference in the size and position of the basal spine, that of Philippi's species being figured as on the front just below the deepest part of the cup, while in the present form and in that figured by Marion and Bobretzky the spine is at the back and rudder-like in form. Philippi also described his species as having the tube concentrically striated, so that there may be some confusion in the identification of the species, and that described and figured by Marion and Bobretzky may be distinct. If, however, upon further study it proves to be the same as Philippi's, this species is erroneously placed in the table on p. 260 and should be transferred to the first group with species whose tubes are unsculptured, the growth lines not being treated as such.

Another animal has the calcareous plate of the operculum composed of two distinct pieces. The end one is a similar, oblique, shallow cup with spreading base, which has an elongated, narrow, median portion thickened along its back, forming three conspicuous serrations; posterior to and in front of the base of this end piece is a large concavo-convex, shield-shaped one which is entirely detached from it and is very unlike the comparatively thin, firm, elongated, shield-shaped protection wall found in the opercula which form brood-pouches. The collar setæ are coarsely serrate with basal fin. The tube is sinistral, of good size, with the surface roughened by faint spiral threads and irregular growth lines. Smaller dextral tubes have the surface ornamented with definite spiral threads crossed by distinct concentric lines. The animal has but a simple calcareous disk in the operculum and the

collar setæ have angular tapered blades. As the article on *Spirorbis*, by Caullery and Mesnil, could not be consulted, these two species could not be identified. The first may be *S. beneti* Marion 1875.

In the posterior segments of one animal of *Spirorbis mutabilis* were clusters of spermatogonia and isolated spermatozoa, also good-sized eggs with large nucleii, this being the only instance noted among the many animals studied. (See pp. 252 and 255.)

Genus **Rhodopsis** nov. (See pp. 179 and 223.)

Tube small, calcareous, hair-like, more or less sigmoid, usually attached its entire length to the under surface of the common hat-coral (*Agaricia fragilis*) from Bermuda.

Animal minute, deep yellow, with the operculum protected by a disproportionately large, chitinous disk covered with numerous unequal irregular light horn-colored processes or spines arranged in the form of a rosette — hence the name.

Branchiæ not determined, appearing as a mass back of the operculum, in the six specimens examined.

Eyes two, conspicuous red, showing beneath the collar.

Thorax short, the segments defined on each side by the 6, in one instance 5, small fascicles of setæ at the end of the 6 series of uncini, there being no separate fascicle on the collar. Body cavity elongated, showing dark brown intestinal tract. Posterior portion usually mutilated; when perfect, ornamented along the dorsal (?) area by long irregular ribbon-like appendages somewhat resembling the spines on the operculum; the elongated segments (about 5) defined on the opposite (ventral ?) area by transverse lines, a series of uncini on the middle of each; but no setæ were seen.

Thoracic setæ bent at the base of the broad abruptly tapered blade. Uncial plates (seen in profile) similar to those of *Filograna*, with about ten rather blunt appressed teeth, the lowest larger than the others; seen in front the broad tapered face has several alternating rows of minute pointed teeth. On the abdomen the uncini were seen only in a front view; the face is broad, of uniform width, and no serrations could be made out even with the $\frac{1}{10}$ oil immersion objective.

Rhodopsis pusillus sp. nov. (See pp. 179 and 223.)

Type locality. — Bermuda.

Numerous small round tubes of uniform diameter, with both ends open, resembling fine wavy white hairs are found scattered over the under surface of the common hat-coral (*Agaricia fragilis*).

They are more or less sigmoid, either isolated or in masses, usually attached their entire length but when too crowded lifting themselves outward, forming a free end. Their surface is roughened by unequal concentric growth lines and they are opaque except for a very small semitransparent portion which in dried specimens is usually about the middle, revealing the position of the minute yellow animal.

Length varying from 5–8 mm.; diameter about $\frac{1}{5}$ mm.

These tubes were supposed to belong to some species of *Filograna;* the animals, however, after treatment with potash solution, were found to differ from those of that genus in possessing an operculum. This is remarkable for the form, size, and arrangement of the spine-like processes covering the thin chitinous disk which protects its end. They are long, blunt, light horn-color, differ greatly in size and form, and appear to be arranged in three alternating series forming a rosette; those of the outer and middle series being very irregular in outline, differing greatly in number and position of the irregularities; those of the inner series more numerous (about 24), smaller, simple, tapered and obliquely truncated.

No setæ were found on the collar, which is apparently without incisions or clefts, shallow across the back, deep along the sides and in front with angular dorso-lateral corners.

Thoracic segments defined only by the 5 or 6 series of uncini and small fascicles of setæ. Abdomen with uncini only, apparently arranged in a single series, along the median area. The surface on the opposite portion of the body covered with long unequal ribbon-like processes resembling in form the spine-like ones on the opercular plate.

Length of the largest perfect animal $\frac{3}{5}$ mm.

Genus **Josephella** Caullery and Mesnil (?). (See p. 226.)

Tubes similar to those given above as belonging to *Rhodopsis pusillus* from Bermuda were found on *Margaritifera* from Beirut, Syria, but the animal is very dissimilar, being elongated with a simple operculum on which the chitinous plate has a deep erect transparent rim strengthened on its upper surface by long, tapered spine-like processes often with secondary spinules. There are 5 thoracic fascicles of tapered setæ and 4 series of uncini; on the following segments the tori with a few uncini and one very slender tapered seta are well separated along the middle region of the body, but more crowded posteriorly; the caudal portion was not found. The setæ below the collar fascicle are bent at the base of the blade and the uncini have a com-

paratively few unequal serrations the lowest one long and fang-like when seen in profile, but in a front view the broad surface has three or four alternating series of slender teeth. With the exception of the operculum these characters seem to agree with those of *Josephella marenzelleri* Caullery and Mesnil (p. 226); the operculum is described by these authors as being borne on the end of a branchia and as having some calcareous deposit; the Mediterranean species may be immature and a fully developed operculum might have some lime deposit. The tube recalls that of *Filograna*, one species of which (*F. corallifica* Pallas 1766) is given by Mörch, 1863, as from the Mediterranean; since no further mention has been found of any similar form, the species, notwithstanding the fact that the operculum appears also to differ in having a definite peduncle, is referred to *Josephella*, as *J. humilis*, but with considerable doubt.

INDEX TO GENERA AND SPECIES

Synonyms are in *italics;* names new to science and pages on which descriptions occur are in **black face type.**

Amphiglena 188
armandi 188
mediterranea 188
Amphitrite 204, 257
volutacornis 183, 184
Anisomelus luteus 227
Apomatopsis 226
similis 226
Apomatus 226, 257, 258
ampulliferus 226, 257
elisabethæ 177
enosimæ 173, 226
globifera 226
similis 226
Aspeira 171, 178, 192, **202**
modesta 178, 179, 192, **202**, 308, 330
sp.? 173
Bispira 183, 184, 185, 192
mariæ 178, 192, 287
polymorpha 172, 214
volutacornis 183
Branchiomma 191
vesiculosum 191
Chitinopoma 224
fabricii 224, 229
greenlandica 224, 229, 332, 339
Chone 171, 185, 189, 190
duneri 216
infundibuliformis 189, 216
teres 180, **215**, 318, 332
Circeis 257, 258, 261
armoricana 257, 258, 261
corrugatus 257
lucidus 257
Crucigera 171, 224, 225, **232**, 240, 241, 242, 243, 245, 254
formosa 180, **233**, 314, 320, 324, 336
Crucigera irregularis 180, **234**, 308, 316, 324, 336
websteri 225, 232
zygophora 172, **233**, 238, 316, 320, 324, 336
Cymospira 222
brachycera 178
gigantea 222
morchi 178

Dasychone 192, 198
argus 198
boholensis 114
cingulata 174, 176
compressa 199
curta 176, 199
decora 192, **198**
havaica 173, 199
infarcta 192, 198
japonica 173
maculata 175
orientalis 174
picta 173
serratibranchis 174
Dasychonopsis 178, 191, **198**, 199
argus 198
compressa 199
curta 176, 199
maculata 175
pallidus 178, 181, 191, 196, **199**
Dasynema 221
chrysogyrus 175, 221
Demonax 184, 186, 191
cooki 173, 186
incertus 176
krusensterni 173, 186, 191
leucaspis 175
picta 173
tilosaulus 175

Dexiospira 256
Dialychone 190, 216
acustica 190, 216
Distylia 183, 184, 185, 192, 209, 210
volutacornis 183, 184, 185, 192
Ditrypa 223
arietina 223
gracillima 175
libera 223
strangulata 178
subulata 223

Eucarphus 225
crucigera 172, 236
cumingii 175, 177, 225
navalis 177
lunulifera 225
ternatensis 175
Euchone 185, 190, 203, 216
alicaudata 173
analis 172, 190, 216
Eudistylia 171, 178, 185, 186, 193, 197, 202, 205, 209
abbreviata 180, 212, 306, 324, 326
gigantea 178, 179, 193, 209, 210, 212, 300, 302, 304, 308, 322, 326
intermedia 180, 214, 325, 326, 328
plumosa 179, 212, 300, 302, 322
polymorpha 172, 214, 316
tenella 170, 180, 213, 302, 304, 324, 326, 328
Eupomatus 225, 227
boltoni 177
dianthus 235
elegans 177
exaltatus 173
fusicola 173
gracilis 180, 234, 312, 326, 332
humilis 180, 235, 337
lunulifera 225
protulicola 235
spongicola 235
uncinatus 225, 235
Eurato 186, 189, 194
manicata 174
melanostigma 194
notata 174
porifera 174
pyrrhogaster 174, 189

Fabricia 184, 189
alata 176
fabricii 189
Filograna 226, 257, 290
corallifica 291
divaricata 177
implexa 226
Filogranula 222, 257
gracilis 222

Galeolaria 222
boltoni 177
cæspitosa 177, 222
decumbens 177
elongata 177
hystrix 175, 177
rosea 177
tetracera 175, 177
Glossopsis 179, 225, 287
minax 175, 179, 225, 287

Haplobranchus 188
aestuarius 188
Hyalopomatopsis 171, 224, 227, 231, 318
marenzelleri 224
occidentalis 180, 229, 338
Hyalopomatus 223
claparedii 223
marenzelleri 224
Hydroides 225, 235, 287
crucigera 172, 236
diplochone 174
elegans 177
furcifera 175, 179, 225, 287
greenlandica 224
minax 175, 179, 225, 287
multispinosa 173, 175
ternatensis 175
norvegica 225, 235
grönlandica 22
protulicola 235
spongicola 235
Hypsicomus 185, 191
hæckelii 185
lyra 173
phæotænia 173
stichophthalmos 191

Janita 223
fimbriata 223

Janua 257, 258, 261
pagenstecheri 257, 258
Jasmineira 183, 189, 190, 193
caudata 183, 190
oculata 193
rubropunctata 183
Josephella 226, 290
humilis 291
marenzelleri 226, 291

Læospira 256
Laonome 190, 191, 197
antarctica 176, 197
hæckelii 185
japonica 173, 178, 191, 197, 198
kröyeri 190, 197
spectabilis 174
tridentata 173
Leodora 256, 257, 258, 261
lævis 257, 258
Leptochone 188

Manayunkia 188, 189
speciosa 188
Megachone 189
aurantiaca 172, 189, 216
Mera 258, 261
pusilla 250, 255, 258
Metachone 179, 190, 216
mollis 179, 180, 190, 216, 328
picta 216
Metalaonome 178, 192, 287
mariæ 178, 192, 287
Metavermilia 179, 220, 223
multicristata 179, 220, 223
nigropileata 176
Myxicola 171, 188
affinis 180, 218, 334
conjuncta 180, 217, 310, 334
glacialis 180, 218, 302, 308, 310, 334
infundibulum 188
ommatophora 175
pacifica 172, 218
platychæta 173
steenstrupi 217, 218, 334

Notaulax 191
rectangulatus 191
sp. 191

Omphalopoma 224
cristata 224
Omphalopoma *fimbriata* 224
langerhansii 174, 224
spinosa 224
umbilicata 175, 224
Omphalopomopsis 224
langerhansii 174, 224
Oria 184, 189
armandi 189
limbata 176
Oriopsis 189
metchnikowi 189

Parachonia 184, 190
letterstedti 190
Paradexiospira 256
Paralæospira 256
Paralaonome 178, 191, 197
antarctica 176
japonica 173, 178, 191, 197, 198
Parasabella 171, 178, 186, 191, 199, 202
maculata 179, 201, 314, 324, 325, 326, 330
media 178, 179, 191, 199, 200, 312, 325, 326, 328, 333
microphthalma 200
sp. 180, 201
Paravermilia 179, 221, 223
bermudensis 179, 221, 223
Phragmatopoma 225
caudata 225
Pileolaria 257, 258, 261
granulata 257
militaris 257, 258
Piratesa 227
nigroannulata 227
Placostegopsis 221
langerhansi 221
Placostegus 221, 226, 287
benthalianus 177
cæruleus 177
cariniferus 177
crystallina 221
fimbriatus 223
langerhansi 221
mörchii 177, 179, 226, 287
ornatus 175, 176
porosus 175

Placostegus sp. 176
tæniatus 178
tricuspidatus 221
tridentatus 221, 288
umbilicatus 175
Polyphragma 225
Pomatoceros 222
auritubis 174
bucephalus 175
elephus 178
helicoides 174
strigiceps 177
tetraceros 175, 177
tricuspis 222
triquetra 222
Pomatostegus 222
actinocerus 175
bowerbanki 178
kröyeri 172, 236
latiscapus 174
macrosoma 222
stellata 222
strigiceps 177
Potamilla 185, 191, 192, 193, 202, 203, 204
acuminata 173
malmgreni 203
myriops 173
neglecta 192, 203
oculifera 204
oligophthalmos 175
polyophthalmos 175
reniformis 172, 178, 185, 193, 203, 204
suavis 173
tenuitorquus 174
torelli 173, 203
tortuosa 204
Potamis 193
malmgreni 203
spathiferus 193, 203
Protis 227, 229
arctica 229
cœcus 227
simplex 227, 229
Protoplacostegus 179, 226, 287
mörchii 177, 179, 226, 287
Protula 226, 227
alba 228
Protula *arctica* 229
atypha 180, 228, 332
diomedeæ 228
dystera 226
geniculata 173
intestinum 227, 228
media 228
rudolphi 227
tubularia 228
Protulides 184, 185, 190
elegans 184, 185, 190
Protulopsis 227, 228
intestinum 227, 228
nigra-nucha 175, 227
Pseudopotamilla 178, 192, 193, 202, 203, 205
debilis 180, 204, 330
myriops 173
oculifera 193, 208, 324, 325, 326, 332, 333
oligophthalmos 175
polyophthalmos 175
reniformis 172, 178, 185, 193, 203, 204, 208
suavis 173
Psygmobranchus 227
cœcus 227
multicostatus 227
protensus 227

Rhodopsis 179, 223, 289
pusillus 179, 223, 289
Romanchella 256, 258, 262
perrieri 258

Sabella 171, 183, 185, 187, 192, 193, 197, 198, 200, 203, 204, 209
acrophthalmos 174
armata 177
aulaconota 173
ceratodaula 177
crassicornis 194, 195
elegans 179, 194, 196, 310, 312, 324, 326, 333
formosa 179, 195, 196, 312, 325, 326, 328, 330
fullo 173
fusca 177
grandis 177

Sabella havaica 173, 199
humilis 179, 195, 312, 330
indica 186
japonica 173
leptalea 179, 195, 190, 312, 324, 325, 326
magelhænsis 176
magnifica 186
manicata 174
melanostigma 194
microphthalma 200
neglecta 203
notata 174
pavonina 192, 193, 194
phœotœnia 173
picta 216
porifera 174
punctulata 177
pyrrhogaster 174
reniformis 172, 203
rubropunctata 183
samoensis 176
saxicava 204
sp. 176
spectabilis 174
sulcata 177
tilosaulus 175
tricolor 173
vancouveri 172, **197**
velata 177
volutacornis 184
zebuensis 174
Sabellastarte 186, 192, 197
indica 186, 192, 197
japonica 197, 198
magnifica 186
spectabilis 174
Salmacina 226, 257
ædificatrix 226
australis 177
cœcus 227
dystera 226
incrustans 226, 257
multicostatus 227
Schizobranchia 171, 178, 186, 193, 197, 205, 212
affinis 179, 205, 209, 324, 328
concinna 179, 205, **208**, 304, 314, 326, 328
Schizobranchia dubia 179, 205, **208**, 314, 316, 324, 330, 332
insignis 170, 178, 179, 193, 205, **206**, 306, 312, 314, 328
nobilis 179, 205, 207, 208, 209, 306, 314, 324, 328
Schizocraspedon 179, 225, 287
furcifera 175, 179, 225, 287
Sclerostyla 224, 225, 232
ctenactis 224
zelandica 177, 232
Serpula 171, 219, 221, 224, 225, 226, 227, 232, 234, 235, 239, 240, 241, 254
actinocerus 175
chrysogyrus 175, 221
columbiana 172, 232
ctenactis 224
dianthus 235
filigrana 177
fimbriata 223
gigantea 222
granulosa 174
implexa 226
jukesii 174, 177, 231
narconensis 176
magellanica 176
ornatus 175
philippensis 175
porrecta 243, 262
quadricornis 175
rugosa 264
splendens 180, 229, 230, 238, 310, 316, 318, 325, 328, 333, 336
sp. 229
tricornigera 175
tridentatus 221
triquetra 221, 222, 229
vasifera 177
vermicularis 176, 224
zelandica 177, 232
zygophora 172, 233
Spirobranchus 222, 223
brachycera 178
giganteus 222
incrassatus 173, **236**, 326, 332, 333
mörchi 178
occidentalis 220
pseudoincrassatus 236

Spirobranchus quadricornis 175
rostratus 178
semperi 175
tricornigerus 175
Spirographis 184, 192
australiensis 177
spallanzanii 192
Spirorbis 171, 172, 219, 221, 222, 224, 229, 230, 231, **236, 252,** 253, 254, 256, 257, 258, 259, 261, 288
abnormis 180, **245,** 254, 260, 262, 268, 337, 338
affinis 241, 264
aggregatus 176, 260, 261, **266**
albus 265
antarcticus 264
argutus 174, 250, 260, 262, 267
armoricanus 258, 260, 261, 266
asperatus 180, **245,** 246, 253, 260, 262, 268, 314, 318
bellulus 174, 250, 260, 262, 267
beneti 260, 261, 265, 289
bernardi 260, 261, 267
borealis 222, 236, 255, 257, 258, 262
cancellatus **248,** 260, 261, 263, 337, 338
carinatus 241, 246, 248, **249,** 260, 263, 264, 265
chilensis 176, 260, 264
claparedei 176, 260, 261, 266
communis **248,** 260, 263
comptus 180, **244,** 260, 261, 268
conicus 248
cornuarietis 239, 260, 261, 264, 288
corrugatus **248,** 257, 260, 263, 267
dorsatus 174, **250,** 260, 267
evolutus 251, 260, 261, 268
eximius 180, **239,** 260, 261, 267, 336
fabricii 264
foraminosus 174, **250,** 260, 262, 267
formosus 251, 254, 260, 262, 268, 236
granulatus 241, 242, 246, **247,** 249, 253, 256, 257, 260, 261, 262, 263, 264, 265, 266, 338
heterostrophus **248,** 249, 260, 263
incisus 178, 246, 265
Spirorbis **incongruus** 180, **241,** 244, 260, 261, 267, 338
inversus 181, **246,** 260, 268
kœhleri 260, 261, 266
lævis 254, 257, 258, 260, 261, 265
lamellosus 178, 246, 264
langerhansi 173, **240,** 260, 261, 267
lebruni 176, 260, 261, 266
levinseni 176, 260, 261, 266
lineatus 180, **242,** 260, 261, 267, 336
lucidus 241, 243, 246, 251, 257, 262
grönlandicus 262
malardi 260, 261, 266
marioni 173, **239,** 240, 260, 261, 266, 336, 338
mediterraneus 260, 261, 266
militaris 247, 258, 260, 261, 265
minutus 248, 263
montagui 264
mörchi 170, 180, 240, 241, 260, 261, 265, 332
mutabilis 252, 260, 261, 268, 289
nautiloides 262, 265
nordenskjöldi 176, 260, 267
pagenstecheri 254, 255, 257, 258, 260, 261, 265
patagonicus 176, 260, 261, 266
perrieri 176, 258, 260, **262,** 266
plicatus 264
ponticus 264
porosus 265
pseudocorrugatus 248, 250, 260, 261, 267
pusilloides 250, 254, 255, 260, 261, 267
pusillus 250, 258, 264, 267
quadrangularis 170, 180, 239, **241,** 247, 249, 253, 260, 261, 264, 337, 338, 339
rugatus 180, 241, **243,** 244, 260, 261, 268, 316, 328
semidentatus 180, **237,** 238, 253, 260, 261, 267, 312
similis 180, **242,** 260, 261, 268, 316, 336, 338
simplex 265
sinistrosus 251, 260, 263, **266**
sp. 248, 264, 338

Spirorbis spirillum 170, 179, 180, 243, 244, 253, 254, 255, 260, 261, 262, 265
lucidus 170, 179, 312, 324, 336, 338
greenlandicus 243
spirorbis 222, 236, 241, 248, 251, 253, 254, 255, 258, 260, 261, 262, 337, 338
stimpsoni 250, 253, 260, 261, 265, 337, 338
sulcatus 247, 248, 249, 260, 261, 263
transversus 263
tricostalis 178, 264
tridentatus 181, 246, 260, 268
tubæformis 251, 260, 261, 268, 336
validus 246, 247, 249, 253, 254, 256, 260, 262, 265, 332, 333
variabilis 180, 237, 238, 243, 246, 254, 260, 261, 267, 316, 336, 338
verruca 247, 249, 260, 261, 264, 265
violaceus 170, 180, 237, 238, 242, 247, 260, 261, 266
vitreus 237, 240, 247, 248, 260, 261, 263
zelandicus 177, 264

Terebella stellata 222
Tubus vermicularis 224
Vermetus porosus 175
Vermilia 220, 222
agglutinata 223
cæspitosa 177
clavigera 223
ctenophora 173
dinema 222
infundibulum 220
multicostata 223
multicristata 179, 220, 223
multivaricosa 220, 223
nigropileata 176, 220
pluriannulata 173
polytrema 220
rosea 177
rostratus 178
serrula 224
sp. 176
spirorbis 220
strigiceps 177
tæniatus 178
triquetra 220, 222
Vermiliopsis 220, 223, 226
agglutinata 223
multivaricosa 220, 223

Zopyrus 224
kœmpferi 177
loveni 176, 224
sp. 176

PLATE XXI.

FIG. 1. *Eudistylia gigantea* sp. nov., p. 210. Lateral view, $\times \frac{1}{4}$.
2. Opposite view of same specimen.
3. *Eudistylia plumosa* sp. nov., p. 212. Ventral view of anterior portion of type, slightly enlarged.
4. Lateral view of same specimen, about natural size.

ALASKA ANNELIDS

HELIOTYPE CO., BOSTON

PLATE XXII.

FIG. 1. *Myxicola glacialis* sp. nov., p. 218. Lateral view of long slender form, × ½.

2. *Eudistylia tenella* sp. nov., p. 213. Ventral view, × ½.

3. Opposite view of same specimen.

4. Branchiæ: *a*, *Eudistylia gigantea* sp. nov., p. 210, showing double end; *b*, *Eudistylia plumosa* sp. nov., p. 212; *c*, *Eudistylia gigantea*, normal; *d*, *Eudistylia gigantea*, medium sized specimen; all × 3.


1
2
3
c
d
b
a
4

PLATE XXIII.

FIG. 1. *Eudistylia gigantea* sp. nov., p. 210. Dorsal view of anterior portion o a medium sized specimen, × 1.

2. *Schizobranchia concinna* sp. nov., p. 208. Dorsal view of type, × ½.

3. Ventral view of same specimen.

4. *Eudistylia tenella* sp. nov., p. 213. Dorsal view of anterior portion of a medium sized specimen, × ½.

5. Lateral view of same specimen.

PLATE XXIV.

FIG. 1. *Schizobranchia insignis* sp. nov., p. 206. Ventral view, × 1.
2. Dorsal view of another specimen.
3. *Schizobranchia nobilis* sp. nov., p. 207. Ventral view, × 1.
4. *Eudistylia abbreviata* sp. nov., p. 212. Lateral view, × 1.

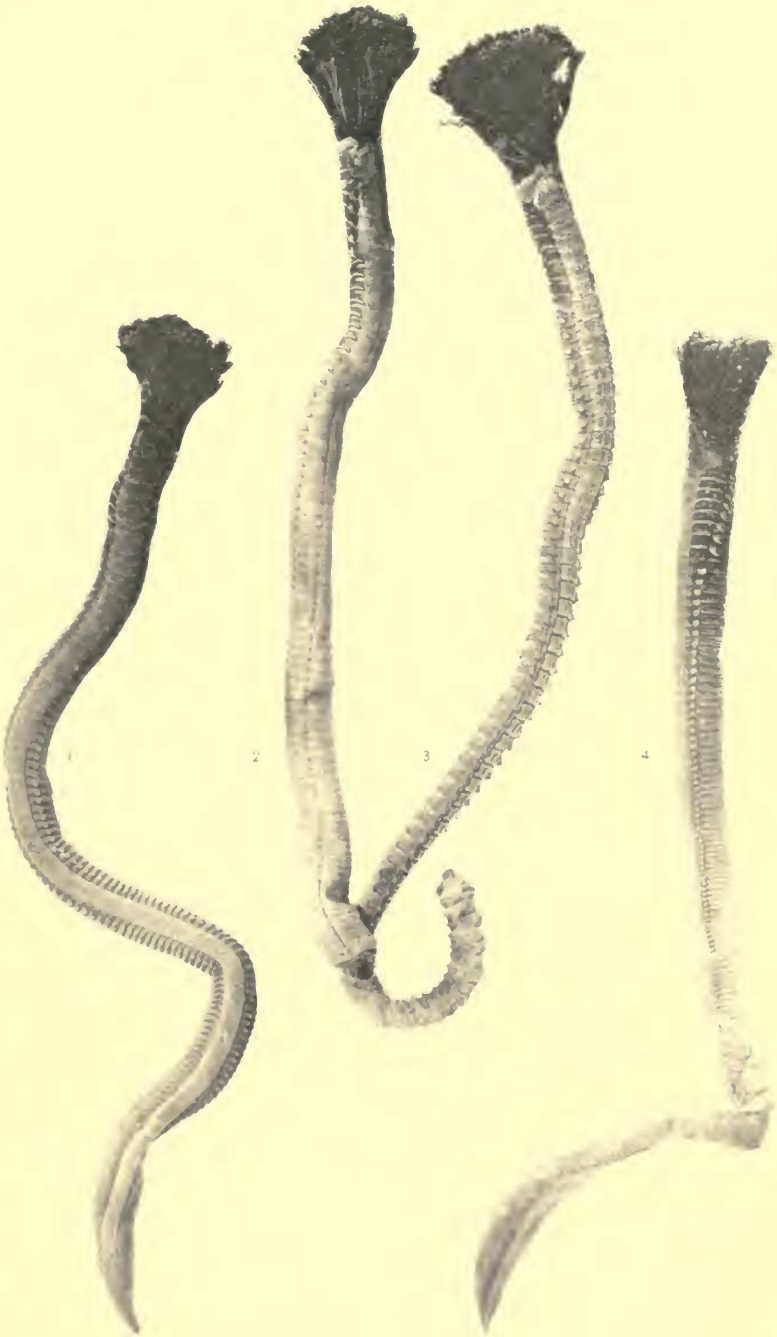
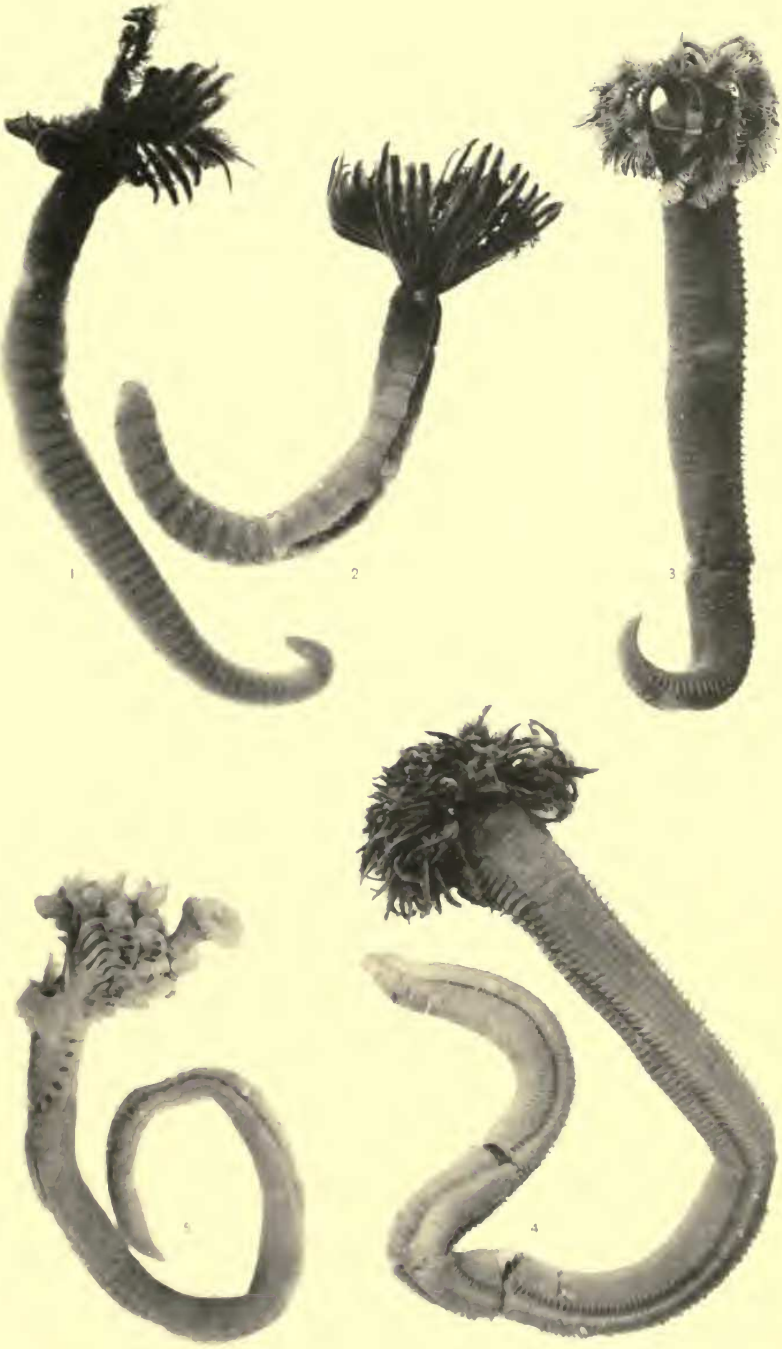

1
2
3
4

PLATE XXV.

FIG. 1. *Myxicola glacialis* sp. nov., p. 218. Lateral view, × 3.
2. Lateral view of another specimen.
3. *Aspeira modesta* sp. nov., p. 202. Dorsal view, × ½.
4. *Eudistylia gigantea* sp. nov., p. 210. Ventral view of a medium sized specimen, × 1.
5. *Crucigera irregularis* sp. nov., p. 234. Lateral view, × 3.



ALASKA ANNELIDS

PLATE XXVI.

FIG. 1. *Myxicola conjuncta* sp. nov., p. 217. Lateral view, slightly enlarged.

2. *Sabella elegans* sp. nov., p. 194. Lateral view, × 3.

3. *Serpula splendens* sp. nov., p. 230. Ventral view of anterior portion, × 4.

4. Branchiæ: *a*, *Myxicola conjuncta* sp. nov., p. 217; *b*, *Myxicola glacialis* sp. nov., p. 218; both × 5.

1

2

3

4

a b

ALASKA ANNELIDS

HELIOTYPE CO., BOSTON

PLATE XXVII.

FIG. 1. *Schizobranchia insignis* sp. nov., p. 206. Lateral view of young specimen in which the branchiæ are being repaired from injury, × 2.

2. *Sabella humilis* sp. nov., p. 195. Dorso-lateral view, × about 4.

3. *Parasabella media* sp. nov., p. 200. Ventral view, × ¾.

4. Dorsal view of same specimen.

5. Portion of two branchiæ, × 4.

6. Terminal portions of branchiæ, × 6: *a*, *Sabella leptalea* sp. nov., p. 195; *b*, *Sabella formosa* sp. nov., p. 196; *c*, *Sabella elegans* sp. nov., p. 194.

7. *Spirorbis semidentatus* sp. nov., p. 237. Lateral view of tube, showing operculum, × 5.

8. *Spirorbis spirillum* Linné var. *lucidus* Montagu, p. 243, from Pacific Grove, on shell of *Cerithium*, × 5.

9. *Eupomatus gracilis* sp. nov., p. 234. Dorsal view of anterior portion of specimen from Pacific Grove, × 4.

10. *Spirorbis semidentatus* sp. nov., p. 237. Top view of two tubes, showing slightly protruding animal, × 5.

ALASKA ANNELIDS

HELIOTYPE CO., BOSTON

PLATE XXVIII.

FIG. 1. *Schizobranchia dubia* sp. nov., p. 208. Lateral view, × 3.
2. *Schizobranchia concinna* sp. nov., p. 208. Dorsal view of anterior portions of a medium sized specimen, × about 3.
3. *Crucigera formosa* sp. nov., p. 233. Branchia without terminal filament, × 5.
4. Another branchia with short terminal filament, × about 2.
5. *Schizobranchia insignis* sp. nov., p. 206. Branchia, × about 2.
6. *Schizobranchia concinna* sp. nov., p. 208. Branchia, × about 2.
7. *Schizobranchia nobilis* sp. nov., p. 207. Branchia, × about 2.
8. *Parasabella maculata* sp. nov., p. 201. Lateral view, × about 2.
9. Ventral view of same specimen.
10. *Spirorbis asperatus* sp. nov., p. 245. Mass of tubes, × about 6.


1


2


3


4


5


6


7


10


9

PLATE XXIX.

FIG. 1. *Schizobranchia dubia* sp. nov., p. 208. Dorso-lateral view, × 5.

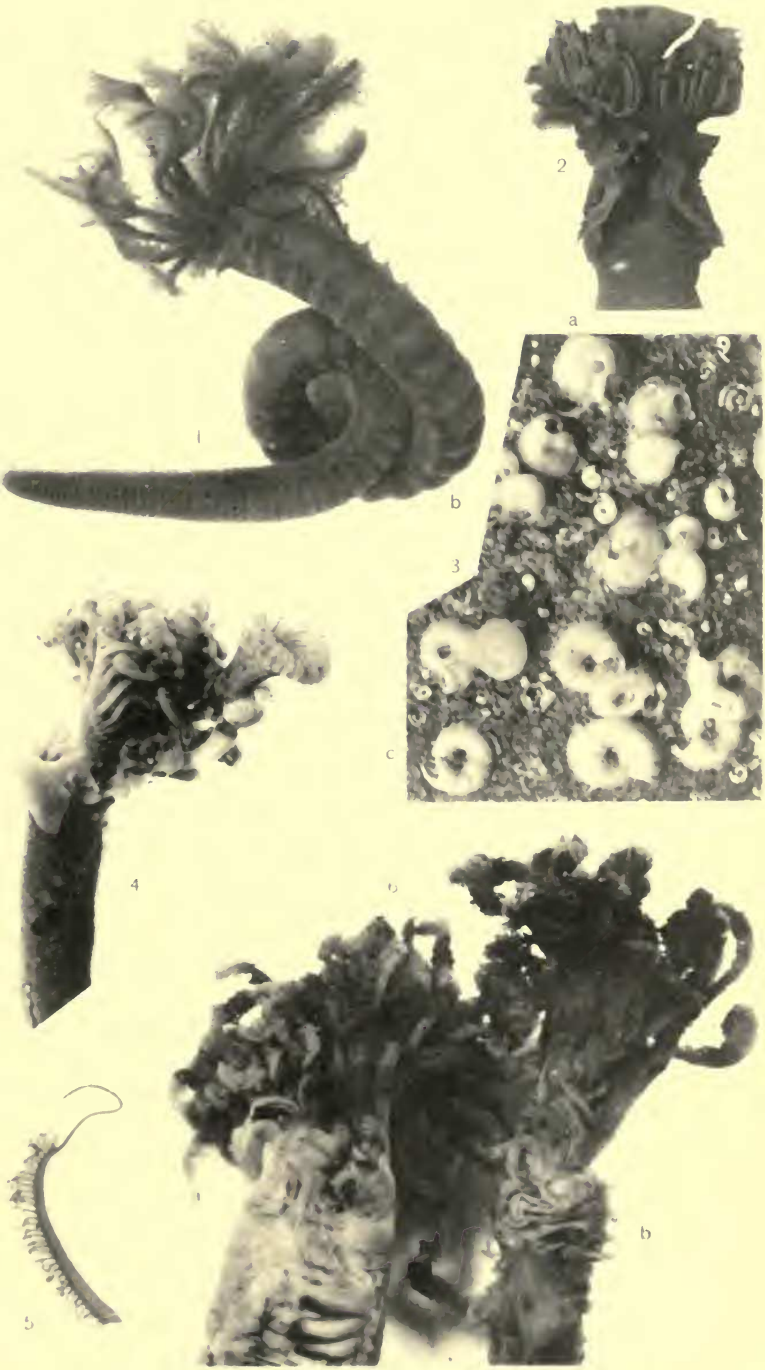
2. *Serpula splendens* sp. nov., p. 230. Dorsal view of anterior portion, showing both primary and secondary operculum, × 2.

3. A piece of stone covered with tubes of *Spirorbis*, × about 4: *a*, Sinistral, vitreous, *Spirorbis variabilis* sp. nov., p. 238; *b*, Dextral, *Spirorbis rugatus* sp. nov., p. 243; *c*, Sinistral, nonglassy, *Spirorbis similis* sp. nov., p. 242.

4. *Crucigera irregularis* sp. nov., p. 234. Lateral view of anterior portion of type, × 3.

5. *Crucigera zygophora* (Johnson), p. 233. Branchia, × 5.

6. *Eudistylia polymorpha* (Johnson), p. 214. Anterior portion of specimen from Victoria, British Columbia, × 4: *a*, cut dorso-ventrally, to show the spiral branchial lobe; *b*, the other half cut laterally, to show height of spiral with branchial membrane.



ALASKA ANNELIDS

HELIOTYPE CO., BOSTON

PLATE XXX.

FIG. 1. *Chone teres* sp. nov., p. 215. Two views of the type, × 2.

2. *Serpula splendens* sp. nov., p. 230. Lateral view of a specimen, showing a portion of the tube covered with tubes of *Spirorbis* and *Hyalopomatopsis*, × 2.

3. Opposite view of another specimen, × 2.

4. *Spirorbis asperatus* sp. nov., p. 245. Mass of tubes of the variety with roughened surface, attached to a gastropod shell, × about 6.

1

2

4

3

PLATE XXXI.

FIG. 1. *Crucigera formosa* sp. nov., p. 233. Dorso-lateral view of type, × 3.
2. *Crucigera zygophora* (Johnson), p. 233. A mass of tubes with their animals, × 2.

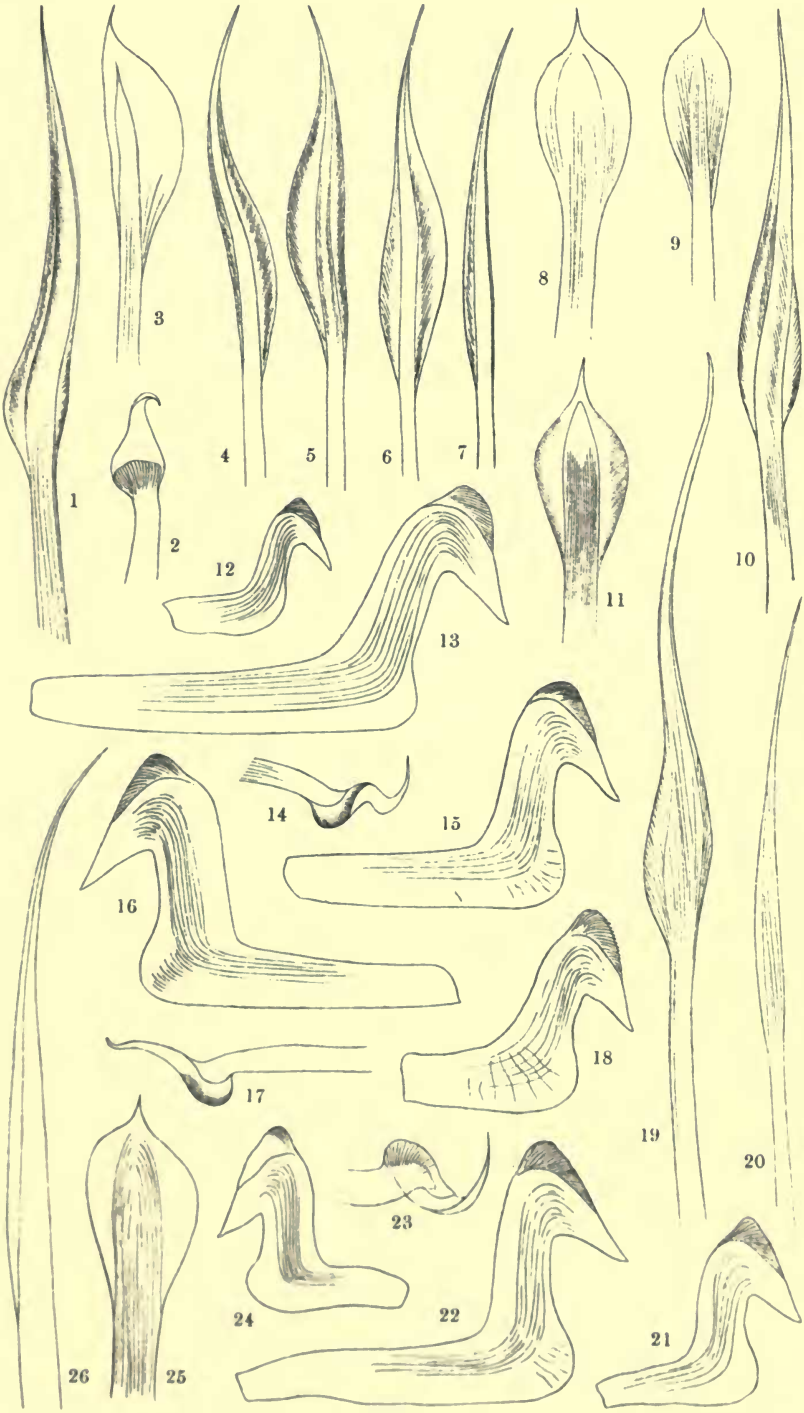
1

2

PLATE XXXII.

FIG. 1. *Eudistylia gigantea* sp. nov., p. 210. Seta from abdomen, about ¾ view.
2. Pennoned seta, from a thoracic torus of another specimen, back view.
3. Inferior thoracic seta below the collar, from the same specimen as fig. 11, about ¾ view.
4. Inferior seta from the collar fascicle of the same specimen as fig. 1, about ¾ view.
5. Another seta from the same fascicle, more turned.
6. Inferior seta from collar fascicle of type, nearly back view.
7. Superior seta from the same fascicle, side view.
8. Inferior thoracic seta below collar of type, back view.
9. *Eudistylia plumosa* sp. nov., p. 212. Inferior thoracic seta below collar of type, nearly back view.
10. *Eudistylia gigantea* sp. nov., p. 210. Seta from abdomen of type.
11. Inferior thoracic seta from the same specimen as fig. 3.
12. Avicular uncinus from a caudal torus of type.
13. Avicular uncinus from a thoracic torus of type.
14. Pennoned seta from same torus, in profile.
15. *Eudistylia plumosa* sp. nov., p. 212. Avicular uncinus from near ventral end of a thoracic torus of type.
16. *Eudistylia gigantea* sp. nov., p. 210. Avicular uncinus from thoracic torus from the same specimen as fig. 1.
17. Pennoned seta from same torus, in profile.
18. *Eudistylia plumosa* sp. nov., p. 212. Avicular uncinus from abdominal torus of type.
19. Seta from abdomen of type.
20. Superior seta from fourth thoracic segment of type.
21. *Eudistylia gigantea* sp. nov., p. 210. Avicular uncinus from abdominal torus of type.
22. *Eudistylia plumosa* sp. nov., p. 212. Avicular uncinus near dorsal end of same thoracic torus as fig. 15.
23. *Eudistylia gigantea* sp. nov., p. 210. Pennoned seta from a thoracic torus of same specimen as fig. 2, another view.
24. Avicular uncinus from abdominal torus of same specimen as fig. 1.
25. Inferior thoracic seta below collar of same specimen as fig. 2.
26. Superior seta from fourth thoracic segment of type.

Figures 1, 4, 5, 6, 7, 9, 10, 19, 20 are by A. H. Verrill, × 196; the others, by the author, × 212.



HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XXXIII.

FIG. 1. *Eudistylia abbreviata* sp. nov., p. 212. Inferior seta from collar fascicle, nearly back view.

2. Superior seta from the same fascicle, in profile.

3. *Crucigera zygophora* (Johnson), p. 233. Posterior portion of a collar seta.

4. *Crucigera formosa* sp. nov., p. 233. Posterior portion of a collar seta, about ¾ view.

5. *Sabella leptalea* sp. nov., p. 195. Avicular uncinus from thoracic torus.

6. *Pseudopotamilla oculifera* (Leidy), p. 204. Pennoned seta from thoracic torus.

7. *Schizobranchia dubia* sp. nov., p. 208. Pennoned seta from thoracic torus.

8. *Parasabella maculata* sp. nov., p. 201. Seta from collar fascicle, in profile.

9. *Schizobranchia affinis* sp. nov., p. 209. Inferior thoracic seta below collar fascicle, about ¾ view.

10. *Eudistylia abbreviata* sp. nov., p. 212. Seta from abdomen, back view.

11. *Schizobranchia affinis* sp. nov., p. 209. Inferior seta from same fascicle as fig. 9, different position.

12. *Parasabella maculata* sp. nov., p. 201. Inferior seta from fourth thoracic segment, about ¾ view.

13. *Crucigera irregularis* sp. nov., p. 234. Posterior portion of a collar seta.

14. *Sabella leptalea* sp. nov., p. 195. Avicular uncinus from abdominal torus.

15. *Spirorbis spirillum* (Linné) var. *lucidus* (Montagu), p. 243. Calcareous plate from operculum.

16. *Eudistylia tenella* sp. nov., p. 213. Pennoned seta from thoracic torus.

17. *Schizobranchia affinis* sp. nov., p. 209. Avicular uncinus from thoracic torus.

18. *Eudistylia abbreviata* sp. nov., p. 212. Pennoned seta from thoracic torus.

19. *Eudistylia tenella* sp. nov., p. 213. Avicular uncinus from abdominal torus.

20. *Sabella elegans* sp. nov., p. 194. Avicular uncinus from thoracic torus.

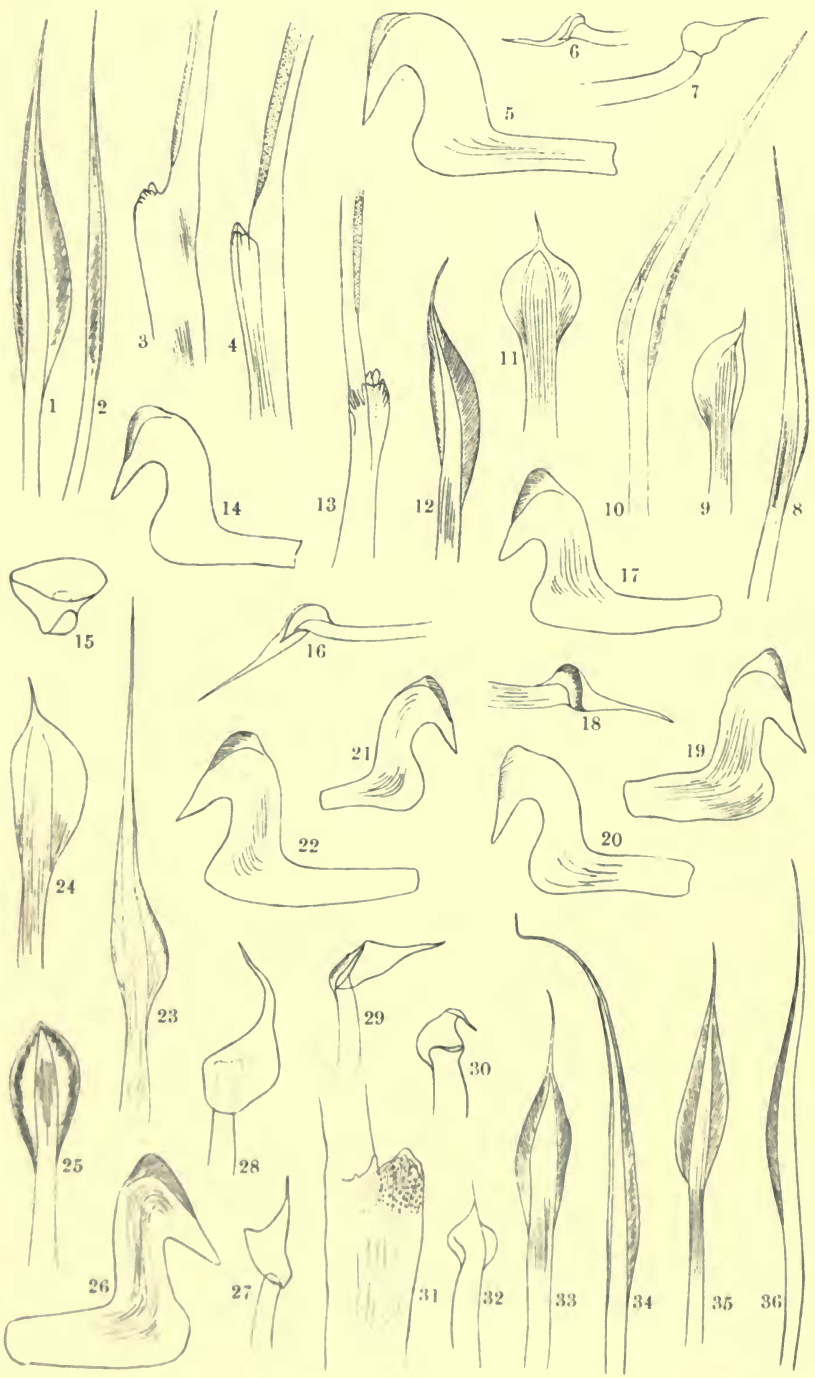
21. Avicular uncinus from abdominal torus.

22. *Schizobranchia nobilis* sp. nov., p. 207. Avicular uncinus from thoracic torus of a young specimen from Dutch Harbor.

23. *Schizobranchia affinis* sp. nov., p. 209. Seta from abdomen, back view.

24. *Eudistylia tenella* sp. nov., p. 213. Inferior thoracic seta below collar.

25. *Eudistylia abbreviata* sp. nov., p. 212. Inferior thoracic seta below collar.



HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XXXIII — *Continued.*

FIG. 26. *Eudistylia intermedia* sp. nov., p. 214. Avicular uncinus from abdominal torus of specimen from Pacific Grove, California.

27. *Sabella leptalea* sp. nov., p. 195. Pennoned seta from a thoracic torus.

28. *Eudistylia intermedia* sp. nov. Pennoned seta from thoracic torus.

29. *Sabella leptalea* sp. nov. Pennoned seta from a thoracic torus, different position from fig. 27.

30. *Pseudopotamilla oculifera* (Leidy), p. 204. Pennoned seta from thoracic torus, different position from fig. 6.

31. *Serpula splendens* sp. nov., p. 230. Posterior portion of seta from collar fascicle.

32. *Sabella formosa* sp. nov., p. 196. Pennoned seta from thoracic torus.

33. *Parasabella maculata* sp. nov., p. 201. Inferior seta from same thoracic segment as fig. 12, different view.

34. *Parasabella media* sp. nov., p. 200. Seta from collar fascicle, about ¾ view.

35. Inferior seta from fourth thoracic segment, back view.

36. Superior seta from same fascicle, in profile.

Figures 1, 2, 21, 23, 25, 34, 35, 36 are by A. H. Verrill, × 222. The others, by the author, × 230, except figure 15, × 37.

PLATE XXXIV.

FIG. 1. *Sabella elegans* sp. nov., p. 194. Seta from collar fascicle, nearly back view.

2. *Parasabella maculata* sp. nov., p. 201. Superior seta from fourth thoracic fascicle, in profile.

3. *Parasabella media* sp. nov., p. 200. Seta from abdomen.

4. *Sabella elegans* sp. nov., p. 194. Inferior seta from fourth thoracic fascicle.

5. Superior seta from same fascicle.

6. *Sabella leptalea* sp. nov., p. 195. Seta from abdomen.

7. Seta from collar fascicle.

8. Superior seta from fourth thoracic fascicle.

9. Inferior seta from same fascicle.

10. *Sabella elegans* sp. nov., p. 194. Seta from abdomen.

11. *Pseudopotamilla oculifera* (Leidy), p. 204. Seta from abdomen, back view.

12. *Eudistylia tenella* sp. nov., p. 213. Avicular uncinus from a thoracic torus.

13. *Eudistylia abbreviata* sp. nov., p. 212. Avicular uncinus from a thoracic torus.

14. *Sabella formosa* sp. nov., p. 196. Avicular uncinus from an abdominal torus.

15. *Schizobranchia concinna* sp. nov., p. 208. Pennoned seta from a thoracic torus.

16. *Eudistylia abbreviata* sp. nov., p. 212. Avicular uncinus from an abdominal torus.

17. *Schizobranchia concinna* sp. nov., p. 208. Avicular uncinus from abdominal torus.

18. Avicular uncinus from thoracic torus, slightly turned.

19. *Eudistylia intermedia* sp. nov., p. 214. Inferior seta from collar fascicle, back view.

20. Seta from abdomen.

21. *Sabella formosa* sp. nov., p. 196. Avicular uncinus from a thoracic torus.

22. *Sabella leptalea* sp. nov., p. 195. Pennoned seta from a thoracic torus.

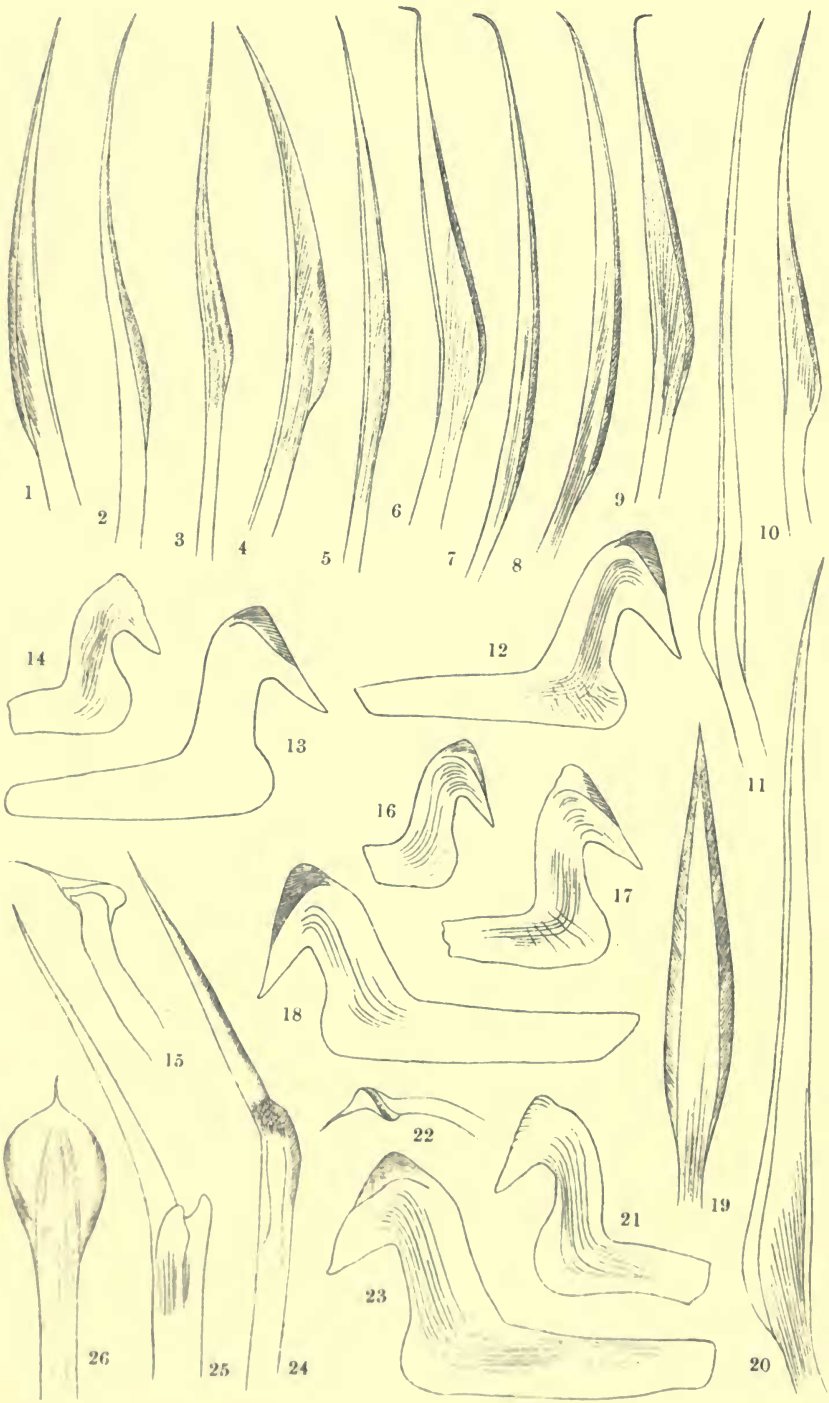
23. *Eudistylia gigantea* sp. nov., p. 210. Avicular uncinus from a thoracic torus, slightly turned.

24. *Spirobranchus incrassatus* (Kröyer), p. 236. Seta from collar fascicle of specimen from Central America.

25. *Eupomatus gracilis* sp. nov., p. 234. Seta from collar fascicle of type from Pacific Grove, California.

26. *Eudistylia intermedia* sp. nov., p. 214. Inferior seta from a thoracic fascicle below collar.

Figures 1, 3–10, 14, 19, 21 are by A. H. Verrill, × 196. The others, by the author, × 212.



HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XXXV.

FIG. 1. *Schizobranchia nobilis* sp. nov., p. 207. Inferior thoracic seta below collar, of type.

2. *Schizobranchia insignis* sp. nov., p. 206. Pennoned seta from thoracic torus of type.

3. *Schizobranchia nobilis* sp. nov., p. 207. Seta from abdomen of type.

4. Pennoned seta from thoracic torus of type.

5. Avicular uncinus from thoracic torus of another specimen.

6. Pennoned seta from same thoracic torus.

7. *Sabella formosa* sp. nov., p. 196. Seta from abdomen.

8. *Schizobranchia nobilis* sp. nov., p. 207. Inferior seta from thorax of type.

9. *Schizobranchia affinis* sp. nov., p. 209. Pennoned seta from thoracic torus, front view.

10. *Schizobranchia nobilis* sp. nov., 207. Avicular uncinus from thoracic torus of type.

11. Inferior thoracic seta from same specimen as fig. 5.

12. *Schizobranchia insignis* sp. nov., p. 206. Superior thoracic seta below collar, same specimen as fig. 2.

13. Seta from abdomen of same specimen.

14. *Spirorbis rugatus* sp. nov., p. 243. Operculum torn away, showing calcareous disk at base.

15. *Schizobranchia insignis* sp. nov., p. 206. Inferior thoracic seta from same specimen as fig. 2.

16. Another inferior seta from same specimen.

17. *Schizobranchia concinna* sp. nov., p. 208. Avicular uncinus from thoracic torus.

18. *Serpula splendens* sp. nov., p. 230. Uncinus from thorax.

19. *Metachone mollis* sp. nov., p. 216. Clavate seta from thorax of type, from Pacific Grove, California.

20. Beaked seta from thorax of same specimen.

21. *Eudistylia intermedia* sp. nov., p. 214. Avicular uncinus from thoracic torus of type.

22. *Eudistylia tenella* sp. nov., p. 213. Avicular uncinus from abdominal torus.

23. *Schizobranchia nobilis* sp. nov., p. 207. Superior seta from collar fascicle.

24. *Schizobranchia concinna* sp. nov., p. 208. Inferior thoracic seta below collar fascicle.

25. *Sabella formosa* sp. nov., p. 196. Inferior seta from thorax of same specimen as fig. 7.

26. *Schizobranchia insignis* sp. nov., p. 206. Avicular uncinus from thoracic torus of same specimen as fig. 2.

27. Avicular uncinus from abdominal torus of same specimen.

28. *Metachone mollis* sp. nov., p. 216. Uncinus from abdomen of type.

29. *Eudistylia intermedia* sp. nov., p. 214. Pennoned seta from same torus as fig. 21.

30. *Sabella formosa* sp. nov., p. 196. Superior seta from thorax of same fascicle as fig. 25.

Figures 3, 7, 8, 12, 13, 15, 16, 23, 24, 25, 30 by A. H. Verrill, × 196; the others, by the author, × 212, except figure 14, × 35.

HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XXXVI.

FIG. 1. *Schizobranchia dubia* sp. nov., p. 208. Pennoned seta from thoracic torus, back view.

2. Avicular uncinus from same torus.

3. Another pennoned seta from thorax, nearly side view.

4. *Sabella humilis* sp. nov., p. 195. Seta from collar fascicle of type.

5. Another seta from collar fascicle.

6. Seta from fourth thoracic fascicle.

7. Pennoned seta from a thoracic torus.

8. Avicular uncinus from an abdominal torus, in profile.

9. Another from same torus, nearly front view.

10. Avicular uncinus from thoracic torus.

11. Pennoned seta from thoracic torus.

12. *Parasabella maculata* sp. nov., p. 201. Avicular uncinus from an abdominal torus.

13. *Parasabella media* sp. nov., p. 200. Avicular uncinus from a thoracic torus.

14. Pennoned seta from a thoracic torus (no potash used).

15. *Parasabella maculata* sp. nov., p. 201. Pennoned seta from a thoracic torus.

16. Avicular uncinus from a thoracic torus.

17. *Schizobranchia dubia* sp. nov., p. 208. One of the shorter or inferior setæ from collar fascicle, back view.

18. Seta from the abdomen, back view.

19. One of the longer or superior setæ from the collar fascicle, in profile.

20. Side view of one of the superior setæ commencing on the second thoracic segment.

21. *Parasabella maculata* sp. nov., p. 201. Pennoned seta from a thoracic torus, different position.

22. An abdominal seta, in profile.

23. *Pseudopotamilla debilis* sp. nov., p. 204. Inferior thoracic seta below collar, from specimen from Pacific Grove, California, about ¾ view.

24. Another from the same fascicle, different position.

25. *Sabella formosa* sp. nov., p. 196. Pennoned seta from thoracic torus.

26. *Pseudopotamilla debilis* sp. nov., p. 204. Avicular thoracic uncinus from specimen from Pacific Grove, California.

27. *Aspeira modesta* sp. nov., p. 202. Pennoned seta from thoracic torus.

28. Seta from abdomen, in profile.

29. One of the longer inferior oblanceolate setæ from the fourth thoracic fascicle.

30. One of the shorter, more nearly spatulate setæ from the same fascicle

31. Pennoned seta from the thoracic torus, different position.

32. *Sabella formosa* sp. nov., p. 196. Pennoned seta from thoracic torus, different position.

33. *Aspeira modesta* sp. nov., p. 202. Superior lanceolate seta from the fourth thoracic fascicle, back view.

34. Avicular uncinus from an abdominal torus.

35. Avicular uncinus from a thoracic torus.

Figures 4–6, 25, 27–30, 32–35 by A. H. Verrill, × 295; the others, by the author, × 300.

HELIOTYPE CO.

PLATE XXXVII.

FIG. 1. *Protula atypha* sp. nov., p. 228. Seta from abdomen of specimen from Pacific Grove, California.

2. Front view of thoracic uncinus apparently without serrations.

3. *Chitinopoma greenlandica* (Mörch) Levinsen, p. 229. Operculum from specimen from Greenland.

4. *Protula atypha* sp. nov., p. 228. Side view of another uncinus from sixth thoracic torus.

5. *Spirorbis validus* Verrill, p. 249. Abdominal seta from specimen from Grand Banks.

6. A simple curved seta from same region.

7. Collar seta showing imperfection in margin.

8. Collar seta from another specimen.

9. *Chitinopoma greenlandica* (Mörch) Levinsen, p. 229. Operculum of specimen on tube of *Nothria conchylega*, from off eastern coast of New England, in 32 fathoms.

10. *Spirorbis validus* Verrill, p. 249. Seta from second thoracic fascicle of animal from Grand Banks.

11. *Pseudopotamilla oculifera* (Leidy), p. 204. Pennoned seta from thorax of specimen from Atlantic Ocean.

12. *Sabella elegans* sp. nov., p. 194. Pennoned seta from thorax.

13. *Pseudopotamilla oculifera* (Leidy), p. 204. Avicular thoracic uncinus from specimen from Atlantic Ocean.

14. Another, showing slight variation.

15. *Spirorbis mörchi* Levinsen, p. 240. Seta from second thoracic fascicle of specimen from the Banks, Atlantic Ocean, in 110–120 fathoms.

16. *Chone teres* sp. nov., p. 215. Seta from first thoracic segment of type, about ¾ view.

17. Seta from abdomen, partly turned.

18. Bayonet seta from thorax.

19. Superior thoracic seta below collar.

20. Inferior thoracic seta below collar.

21. Hooked thoracic seta from fourth segment.

22. Abdominal uncinus.

23. Another, showing variation.

24. *Spirorbis mörchi* Levinsen, p. 240. Collar seta from same specimen as fig. 15.

25. *Spirobranchus incrassatus* (Kröyer), p. 236. Thoracic uncinus from specimen from Central America.

26. *Eupomatus gracilis* sp. nov., p. 234. Thoracic uncinus from specimen from Pacific Grove, California.

27. Abdominal uncinus.

28. *Schizobranchia dubia* sp. nov., p. 208. Inferior thoracic seta below collar, back view.

HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XXXVII — *Continued.*

FIG. 29. *Pseudopotamilla oculifera* (Leidy), p. 204. Inferior thoracic seta from specimen from Atlantic Ocean, back view.

30. *Parasabella media* sp. nov., p. 200. Pennoned seta from thorax, back view.

31. *Serpula splendens* sp. nov., p. 230. Front view of thoracic uncinus.

32. *Spirorbis validus* Verrill, p. 249. Odd seta from third thoracic fascicle of specimen from Grand Banks.

33. *Sabella elegans* sp. nov., p. 194. Another pennoned seta from thoracic torus, back view.

34. *Spirobranchus incrassatus* (Kröyer), p. 236. Thoracic seta.

Figures by the author: 2, 4, 26, 27, 31, × 330; 3, 9, × 50; the others, × 295.

PLATE XXXVIII.

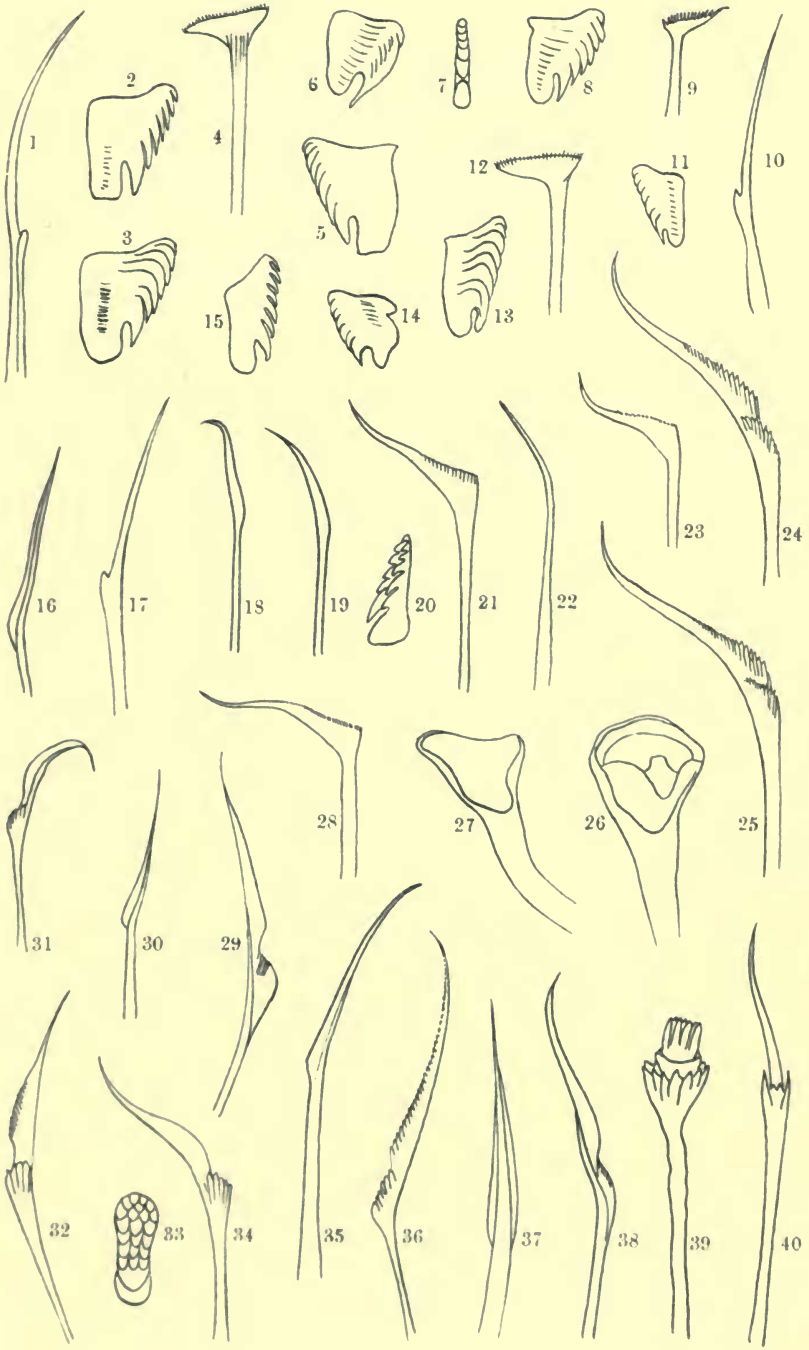
FIG. 1. *Myxicola conjuncta* sp. nov., p. 217. Seta from thorax, side view.
2. Another seta from a thoracic fascicle, side view.
3. Only hooked seta found on sixth thoracic segment.
4. Dark, sharply pointed, spear-shaped seta from eighth thoracic segment.
5. Seta from a thoracic fascicle, back view.
6. Light-colored spear-shaped seta from abdomen.
7. Only hooked seta found on seventh thoracic segment.
8. Only hooked seta found on fourth thoracic segment, more turned.
9. Dark spear-shaped seta from eighth thoracic segment, more blunt than fig. 4.
10. Uncial plate from abdomen.
11. Another, showing variation in form.
12. *Myxicola glacialis* sp. nov., p. 218. Uncial plate from fourth segment (first abdominal).
13. *Myxicola steenstrupi* Krōyer, p. 218. Uncial plate from abdomen of a specimen from the Bay of Fundy.
14. Another, showing variation in form.
15. One of the 4 or 5 hooked setæ from sixth thoracic segment.
16. Another from seventh thoracic segment, more turned.
17. *Myxicola affinis* sp. nov., p. 218. Uncial plate from abdomen of specimen from Pacific Grove, California.
18. Another, showing variation in form.
19. Hooked seta from thorax.
20. Another, different view.
21. *Myxicola steenstrupi* Krōyer, p. 218. Hooked seta from eighth thoracic segment of same specimen as fig. 13.
22. Another from same segment, different view.
23. *Myxicola glacialis* sp. nov., p. 218. Uncial plate from abdomen of another specimen.
24. *Myxicola steenstrupi* Krōyer. Seta from thorax of same specimen as fig. 13, nearly back view, similar to those on abdomen.
25. *Myxicola glacialis* sp. nov., p. 218. Seta from second thoracic segment of same specimen as fig. 12, back view.
26. Seta from first thoracic segment of same specimen, back view.
27. Seta from abdomen of same specimen as fig. 23, back view.
28. Abdominal seta from same specimen.
29. Seta from thorax of same specimen, back view.
30. Sharp spear-shaped seta from thorax of same specimen.
31. One of 4 hooked setæ from third thoracic segment of same specimen as fig. 12.
32. Blunter spear-shaped seta from thorax of same specimen as fig. 30.

All the figures by the author, × 530.

HELIOTYPE CO.

PLATE XXXIX.

FIG. 1. *Crucigera irregularis* sp. nov., p. 234. Collar seta from type.
2. Uncial plate from thorax.
3. Uncial plate from abdomen.
4. Seta from abdomen.
5. Another uncial plate from thorax.
6. *Crucigera formosa* sp. nov., p. 233. Uncial plate from thorax of type, showing abnormal development.
7. Abdominal uncinus, front view.
8. *Crucigera zygophora* (Johnson), p. 233. Abdominal uncinus.
9. *Spirorbis eximius* sp. nov., p. 239. Caudal seta from specimen from Pacific Grove, California.
10. *Crucigera formosa* sp. nov., p. 233. Collar seta.
11. Abdominal uncinus.
12. *Crucigera zygophora* (Johnson), p. 233. Abdominal seta.
13. Thoracic uncinus.
14. *Crucigera formosa* sp. nov., p. 233. Another uncinus from thorax, more normally developed than fig. 6.
15. *Crucigera zygophora* (Johnson), p. 233. Another abdominal uncinus.
16. *Spirorbis similis* sp. nov., p. 242. Seta from second thoracic fascicle.
17. *Crucigera zygophora* (Johnson), p. 233. Collar seta.
18. *Spirorbis formosus* sp. nov., p. 251. Collar seta.
19. Another, from different specimen.
20. *Crucigera zygophora* (Johnson), p. 233. Thoracic uncinus, about ¾ view.
21. *Spirorbis spirillum* (Linné) var. *lucidus* (Montagu), p. 243. Collar seta from specimen from Casco Bay.
22. Capillary seta from thorax of a specimen from Pacific coast.
23. Collar seta from another specimen from Atlantic coast.
24. *Spirorbis variabilis* sp. nov., p. 238. Collar seta.
25. Another, showing variations in serrations.
26. *Spirorbis marioni* Caullery and Mesnil, p. 239. Nearly front view of operculum, showing calcareous plate of specimen from Mexico.
27. Side view of same.
28. *Spirorbis spirillum* (Linné) var. *lucidus* (Montagu), p. 243. Collar seta from specimen from Pacific Grove, California.
29. *Spirorbis lineatus* sp. nov., p. 242. Collar seta.
30. *Spirorbis tubæformis* sp. nov., p. 251. Seta from second thoracic fascicle of specimen from Long Island Sound.
31. *Spirorbis similis* sp. nov., p. 242. Collar seta from immature specimen.
32. *Spirorbis tubæformis* sp. nov., p. 251. Collar seta from same specimen as fig. 30.
33. *Serpula splendens* sp. nov., p. 230. Caudal uncinus, front view, much enlarged.



HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XXXIX — *Continued.*

FIG 34. *Spirorbis spirorbis* (Linné), p. 262. Collar seta from specimen from Gloucester, Massachusetts, Atlantic coast.

35. *Spirorbis abnormis* sp. nov., p. 245. Collar seta, short one.

36. *Spirorbis cancellatus* Fabricius, p. 248. Collar seta.

37. *Spirorbis quadrangularis* Stimpson, p. 241. Back view of seta from second thoracic fascicle, from Greenland.

38. *Spirorbis stimpsoni* Verrill, p. 250. Collar seta, about ¾ view.

39. *Eupomatus humilis* sp. nov., p. 235. Operculum from specimen from Mexico.

40. Collar seta, front view, showing arrangement of four basal spines.

All the figures by the author: 1, 10, 17, 26, 27, 39, × 68; the others, except 33, × 425.

PLATE XL.

FIG. 1. *Spirorbis abnormis* sp. nov., p. 245. Front view of calcareous plate from operculum of a young specimen.

2. Side view of same.

3. *Hyalopomatopsis occidentalis* sp. nov., p. 229. Abdominal seta.

4. *Spirorbis variabilis* sp. nov., p. 238. Caudal seta.

5. *Spirorbis spirorbis* (Linné), p. 262. Collar seta of specimen from Gloucester, Massachusetts, back view.

6. Odd seta from third thoracic fascicle, about ¾ view.

7. *Spirorbis spirillum* (Linné) var. *lucidus* (Montagu), p. 243. Caudal seta of specimen from Pacific.

8. *Spirorbis spirorbis* (Linné), p. 262. Entire seta from one of a chain of embryos taken from tube.

9. *Spirorbis similis* sp. nov., p. 242. Collar seta.

10. *Spirorbis quadrangularis* Stimpson, p. 241. Collar seta of specimen from Greenland, about ¾ view.

11. Curved abdominal seta.

12. *Spirorbis spirorbis* (Linné), p. 262. Collar seta from another specimen.

13. Seta from second or third thoracic fascicle.

14. Side view of odd seta from third thoracic fascicle.

15. Caudal seta.

16. *Spirorbis marioni* Caullery and Mesnil, p. 239. Collar seta of specimen from Mexico.

17. *Spirorbis similis* sp. nov., p. 242. Back view of operculum of a young specimen, showing calcareous plate.

18. Front view of same.

19. *Spirorbis incongruus* sp. nov., p. 241. Front view of calcareous plate from operculum.

20. Back view of same.

21. *Spirorbis quadrangularis* Stimpson, p. 241. Seta from second or third thoracic fascicle, in profile.

22. *Hyalopomatopsis occidentalis* sp. nov., p. 229. Collar seta, basal fin much spread.

23. *Spirorbis quadrangularis* Stimpson, p. 241. Collar seta of specimen from the Banks, Atlantic Ocean.

24. *Spirorbis granulatus* Linné, p. 247. Collar seta of specimen from the Banks, Atlantic Ocean.

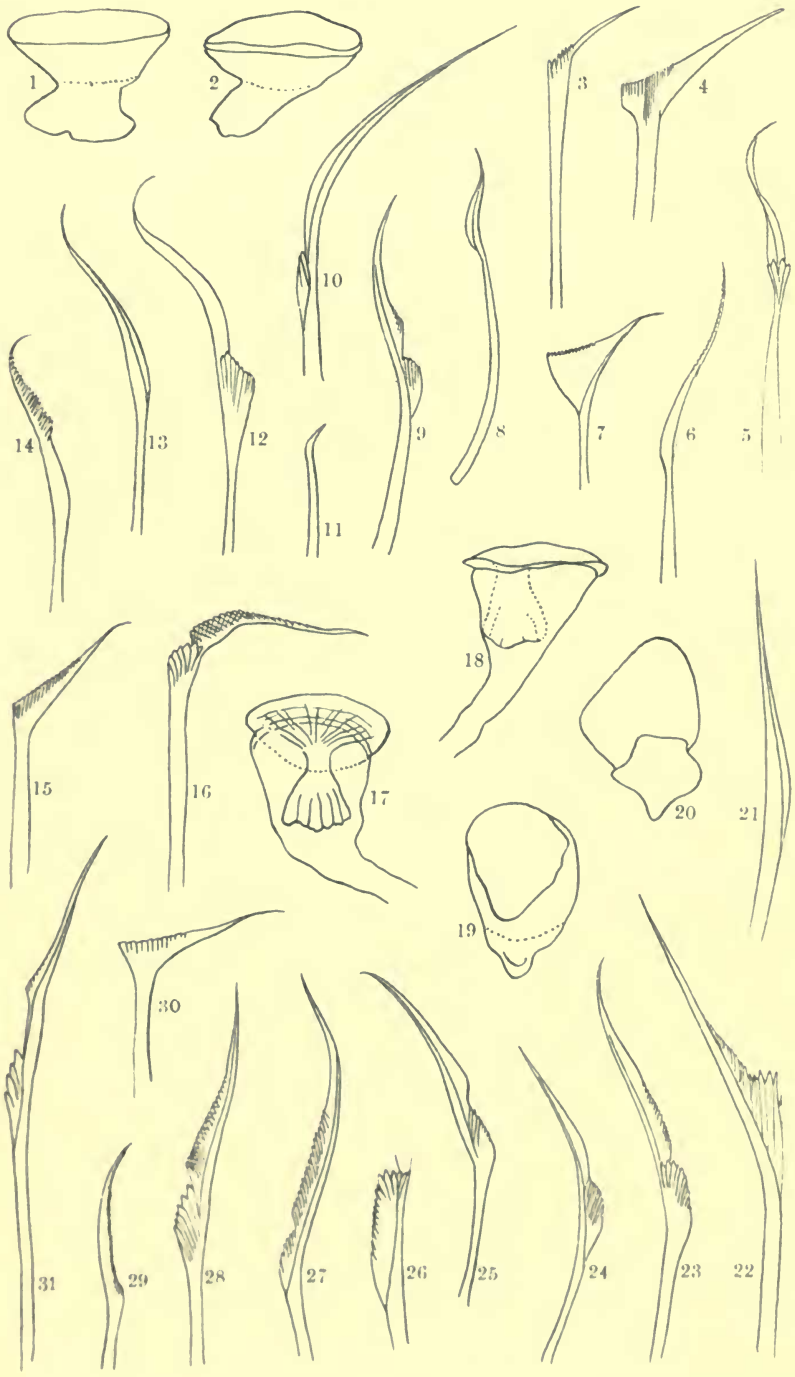
25. *Spirorbis* sp. Collar seta.

26. *Spirorbis quadrangularis* Stimpson, p. 241. Base of collar seta (blade broken) from specimen from Greenland.

27. *Spirorbis cancellatus* Fabricius, p. 248. Collar seta.

28. *Spirorbis incongruus* sp. nov., p. 241. Collar seta.

29. *Spirorbis stimpsoni* Verrill, p. 250. Odd seta from third thoracic fascicle.



HELIOTYPE CO

PLATE XL— *Continued.*

FIG. 30. *Spirorbis quadrangularis* Stimpson, p. 241. Caudal seta of specimen from Greenland.

31. *Chitinopoma greenlandica* (Mörch) Levinsen, p. 229. One of the shorter collar setæ (longest ones broken) of specimen on tubes of *Nothria conchylega* from off the eastern coast of New England, in 32 fathoms.

All figures by the author: 1, 2, 17–20, × 65; others, × 398.

PLATE XLI.

FIG. 1. *Spirorbis violaceus* Levinsen, p. 242. Collar seta from specimen from the Grand Banks, Atlantic Ocean.

2. Another collar seta.

3. *Spirorbis verruca* (Fabricius), p. 247. Collar seta showing slight posterior notch in margin, from specimen on *Chlamys islandicus* from Greenland.

4. *Spirorbis asperatus* sp. nov., p. 245. Collar seta (serrations too distinctly marked).

5. Abdominal seta, back view.

6. Collar seta of another specimen (serrations invisible).

7. *Spirorbis eximius* sp. nov., p. 239. Seta from second thoracic segment of specimen from Pacific Grove, California.

8. *Spirorbis asperatus* sp. nov., p. 245. Curved shaft associated with abdominal seta.

9. *Spirorbis sulcatus* (Adams), p. 249. Collar seta from specimen on *Haliotis* from Guernsey, England.

10. *Spirorbis asperatus* sp. nov., p. 245. Abdominal seta (no serrations), profile view.

11. Apparent arrangement of teeth on uncini, greatly enlarged.

12. *Spirorbis verruca* (Fabricius), p. 247. Another collar seta showing but very slight indication of posterior notch.

13. *Spirorbis semidentatus* sp. nov., p. 237. Capillary seta from thorax.

14. *Spirorbis vitreus* (Fabricius), p. 247. Collar seta from specimen from the Banks, Atlantic Ocean.

15. *Spirorbis mörchi* Levinsen, p. 240. Caudal seta from Alaska specimen, back view.

16. Another, in profile.

17. *Spirorbis semidentatus* sp. nov., p. 237. Caudal seta.

18. *Spirorbis eximius* sp. nov., p. 239. Collar seta.

19. *Spirorbis asperatus* sp. nov., p. 245. Uncial plate from thorax, about $\frac{3}{4}$ view.

20. *Spirorbis eximius* sp. nov., p. 239. Odd seta from third thoracic fascicle.

21. *Spirorbis mörchi* Levinsen, p. 240. Collar seta from specimen on *Chlamys islandicus* from Greenland.

22. *Spirorbis formosus* sp. nov., p. 251. Caudal seta from specimen from Bermuda.

23. *Spirorbis semidentatus* sp. nov., p. 237. Another caudal seta.

24. *Spirorbis mörchi* Levinsen, p. 240. Seta from third thoracic fascicle of Alaska specimen.

25. Collar seta from same specimen.

26. *Spirorbis semidentatus* sp. nov., p. 237. Seta from second or third fascicle.

HELIOTYPE CO.

PLATE XLI — *Continued.*

FIG. 27. Collar seta turned, showing upper surface.
28. Uncial plate from thorax, in profile.
29. Collar seta, in profile.
30. Odd seta of third thoracic fascicle, end spread open.
31. *Spirorbis asperatus* sp. nov., p. 245. Uncial plate; apparent aspect of front surface.
32. Uncial plate from thorax, in profile.

All figures by the author, × 355, except 11 and 31, more enlarged.

PLATE XLII.

FIG. 1. *Spirorbis spirillum* (Linné) var. *lucidus* (Montagu), p. 243. Back view of a calcareous plate from an operculum of specimen from Greenland.

2. Nearly front view of an operculum showing calcareous plate from another specimen from Greenland.

3. Calcareous plate from operculum of a specimen (typical *lucidus*) from Casco Bay.

4. Operculum of specimen from same locality, showing calcareous plate covered with a minute seaweed.

5. Back view of fig. 3.

6. *Spirorbis vitreus* (Fabricius), p. 247. Calcareous plate from operculum of specimen from the Banks, Atlantic Ocean.

7. Top view of same.

8. *Spirorbis violaceus* Levinsen, p. 242. Operculum showing calcareous plate of specimen from Grand Banks.

9. Opposite view of same.

10. Bottom view of calcareous plate from another operculum.

11. Back view of same.

12. Front view of same.

13. *Spirorbis tubæformis* sp. nov., p. 251. Back view of an operculum showing calcareous plate of specimen from Long Island Sound.

14. From view of same, the plate covered with seaweed.

15. *Spirorbis spirorbis* (Linné), p. 236. Back view of an operculum from a full-grown specimen from Gloucester, Massachusetts.

16. Side view of an operculum of a medium sized specimen, showing calcareous plate.

17. Front view of fig. 15; the plate covered with minute protozoans.

18. Back view of an operculum showing operculum plate, of a young specimen.

19. Front view of same.

20. *Spirorbis evolutus* sp. nov., p. 251. Front view of an operculum showing calcareous plate of specimen from Grand Banks.

21. Opposite view of same.

22. Side view of same.

23. *Spirorbis quadrangularis* Stimpson, p. 241. Side view of calcareous plate of specimen from Greenland.

24. Front view of calcareous plate, fig. 28.

25. Back view of same.

26. Opposite view of fig. 23.

27. Side view of operculum of a specimen from Greenland collected and identified as *S. granulatus* by Moore, 1902.

28. Front view of another operculum from specimen from same locality.

29. Opposite view of same.

HELIOTYPE CO.

PLATE XLII—*Continued.*

FIG. 30. *Spirorbis cancellatus* (Fabricius), p. 248. Bottom view of a calcareous plate.

31. Nearly front view of same.

32. Operculum showing calcareous plate becoming detached.

33. Back view of fig. 31.

34. Opposite view of fig. 32.

All figures by the author, × 43.

PLATE XLIII.

FIG. 1. *Spirorbis asperatus* sp. nov., p. 245. Front view of operculum showing calcareous plate.

2. Front view of a calcareous plate from another operculum.

3. Back view of same.

4. *Spirorbis semidentatus* sp. nov., p. 237. Calcareous plate from operculum.

5. Top view of same.

6. *Spirorbis eximius* sp. nov., p. 239. Calcareous plate from operculum of type, from Pacific Grove, California, bottom view.

7. *Spirorbis asperatus* sp. nov., p. 245. Back view of a calcareous plate from a smaller operculum.

8. *Spirorbis sulcatus* (Adams), p. 249. Front view of calcareous plate from operculum of specimen on *Haliotis* from Guernsey, England.

9. *Spirorbis spirillum* Linné, p. 243. Calcareous plate from operculum of specimen from Sitka, front view.

10. Back view of same.

11. *Spirorbis eximius* sp. nov., p. 239. Calcareous plate of operculum from type, nearly side view.

12. *Spirorbis semidentatus* sp. nov., p. 237. Operculum showing calcareous plate.

13. *Spirorbis asperatus* sp. nov., p. 245. Side view of an operculum showing calcareous plate.

14. *Spirorbis quadrangularis* Stimpson, p. 241. Operculum showing eggs and calcareous plate, from Greenland.

15. Operculum, in profile, from specimen from Alaska.

16. *Spirorbis variabilis* sp. nov., p. 238. Calcareous plate from operculum, to show the separation of two disks.

17. *Spirorbis eximius* sp. nov., p. 239. Front view of operculum showing calcareous plate.

18. *Spirorbis formosus* sp. nov., p. 251. Operculum of a medium sized animal, with empty calcareous cylinder.

19. *Spirorbis sulcatus* (Adams), p. 249. Back view of fig. 8.

20. *Spirorbis stimpsoni* Verrill, p. 250. Operculum showing primary calcareous plate.

21. Another operculum filled with embryos, with secondary calcareous plate.

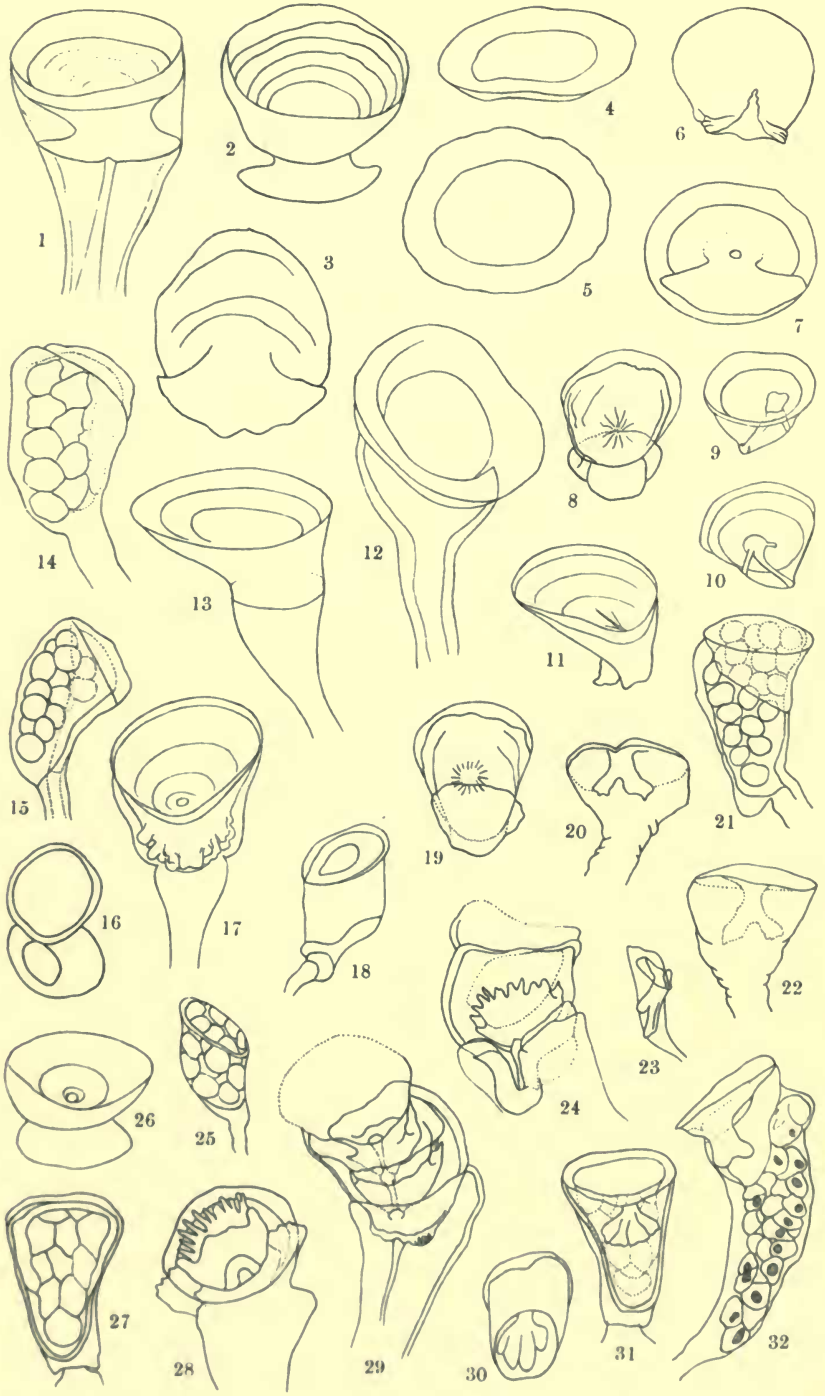
22. Back view of fig. 20.

23. *Spirorbis formosus* sp. nov., p. 251. Posterior portion of operculum showing renewal of plate.

24. *Spirorbis abnormis* sp. nov., p. 245. Back view of fig. 28.

25. *Spirorbis formosus* sp. nov., p. 251. Operculum showing calcareous cylinder filled with embryos.

26. *Spirorbis asperatus* sp. nov., p. 245. Front view of calcareous plate from a small operculum.



HELIOTYPE CO.

ALASKA ANNELIDS

PLATE XLIII—*Continued.*

FIG. 27. *Spirorbis similis* sp. nov., p. 242. Back view of operculum filled with eggs.

28. *Spirorbis abnormis* sp. nov., p. 245. Operculum showing one plate, the other being torn away. Embryos with large white patches which filled the operculum are not represented.

29. Front view of another operculum with 3 calcareous plates.

30. *Spirorbis formosus* sp. nov., p. 251. Detached calcareous cylinder showing interior.

31. *Spirorbis similis* sp. nov., p. 242. Front view of fig. 27, showing calcareous plate.

32. *Spirorbis granulatus* (Linné), p. 247. Operculum filled with embryos, showing conspicuous white patches and primary calcareous plate on the top, splitting from secondary one. Specimen from off New England coast, in 110–120 fathoms.

All figures by the author, × 35.

PLATE XLIV.

FIG. 1. *Spirorbis verruca* (Fabricius), p. 247. Back view of a double operculum plate showing the primary and secondary ones before separation.

2. *Hyalopomatopsis occidentalis* sp. nov., p. 229. Operculum, in which a delicate yellowish (horny ?) cap is partially defined.

3. *Pomatoceros triquetra* (Linné), p. 222. Operculum plate from a specimen from Denmark in the Yale University Museum.

4. *Hyalopomatopsis occidentalis* sp. nov., p. 229. Another operculum, less convex on top, showing conspicuous air-bubble.

5. *Spirorbis* sp.? Operculum showing a large calcareous plate, from an animal forming a tube which resembles that of *Spirorbis spirorbis* (Linné) from Greenland. As the collar setæ could not be found, the species remains undetermined. It may be the very young of one of the larger forms.

6. The same operculum in another position.

7. *Protula media* Stimpson, p. 228. Reproduction of Professor Verrill's figure published in Transactions of the Connecticut Academy, 1874.

8. *Hyalopomatopsis occidentalis* sp. nov., p. 229. Operculum from a full-grown animal, showing distinct central cavity and canal in peduncle, on the end of which algæ are growing.

9. Outline sketch of the anterior portion of a young animal.

10. *Spirorbis* sp.? Operculum of animal from Alaska.

11. *Spirorbis validus* Verrill, p. 249. Back view of a calcareous plate.

12. The same plate in another position.

13. Opposite view to fig. 11.

14. A double plate showing primary one about splitting away. Both specimens were on *Buccinum* from the Grand Banks, in 36–51 fathoms.

15. *Spirorbis* sp.? Front view of fig. 5.

16. *Spirorbis verruca* (Fabricius), p. 247. Opposite view to fig. 1.

17. *Spirorbis variabilis* sp. nov., p. 238. Operculum with minute protozoans on end, side view.

18. *Spirorbis rugatus* sp. nov., p. 243. Front view of operculum showing plate.

19. Side view.

20. *Spirorbis mörchi* Levinsen, p. 240. Operculum showing large calcareous cap, from specimen from off the eastern coast of New England, in 110–120 fathoms.

21. Back view of another operculum, showing eggs.

22. *Eupomatus humilis* sp. nov., p. 235. Operculum greatly enlarged.

All figures by the author, × 30, except 3, × 90; 7, × ½, and 22, × 278.

HELIOTYPE CO.

ALASKA ANNELIDS